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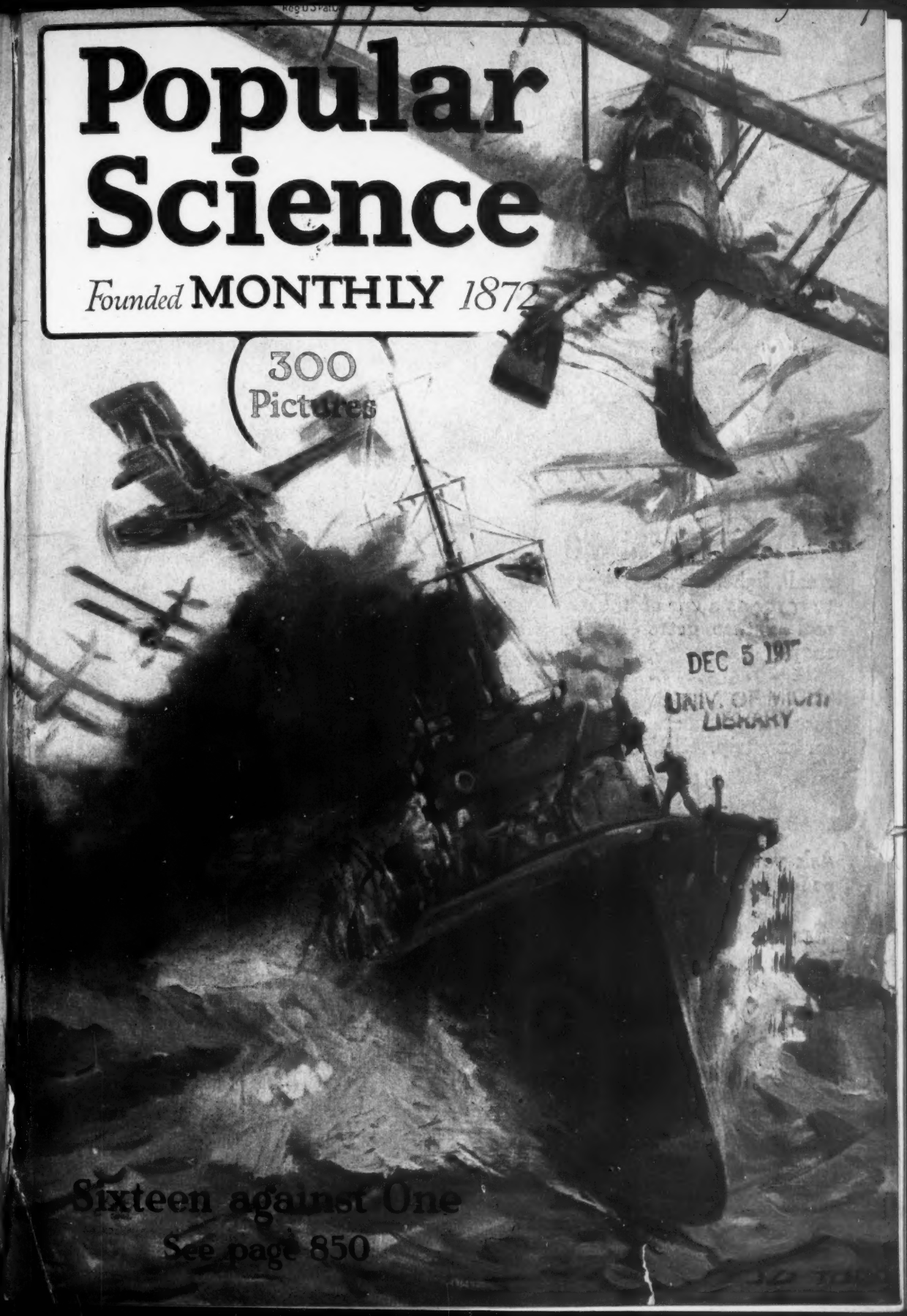

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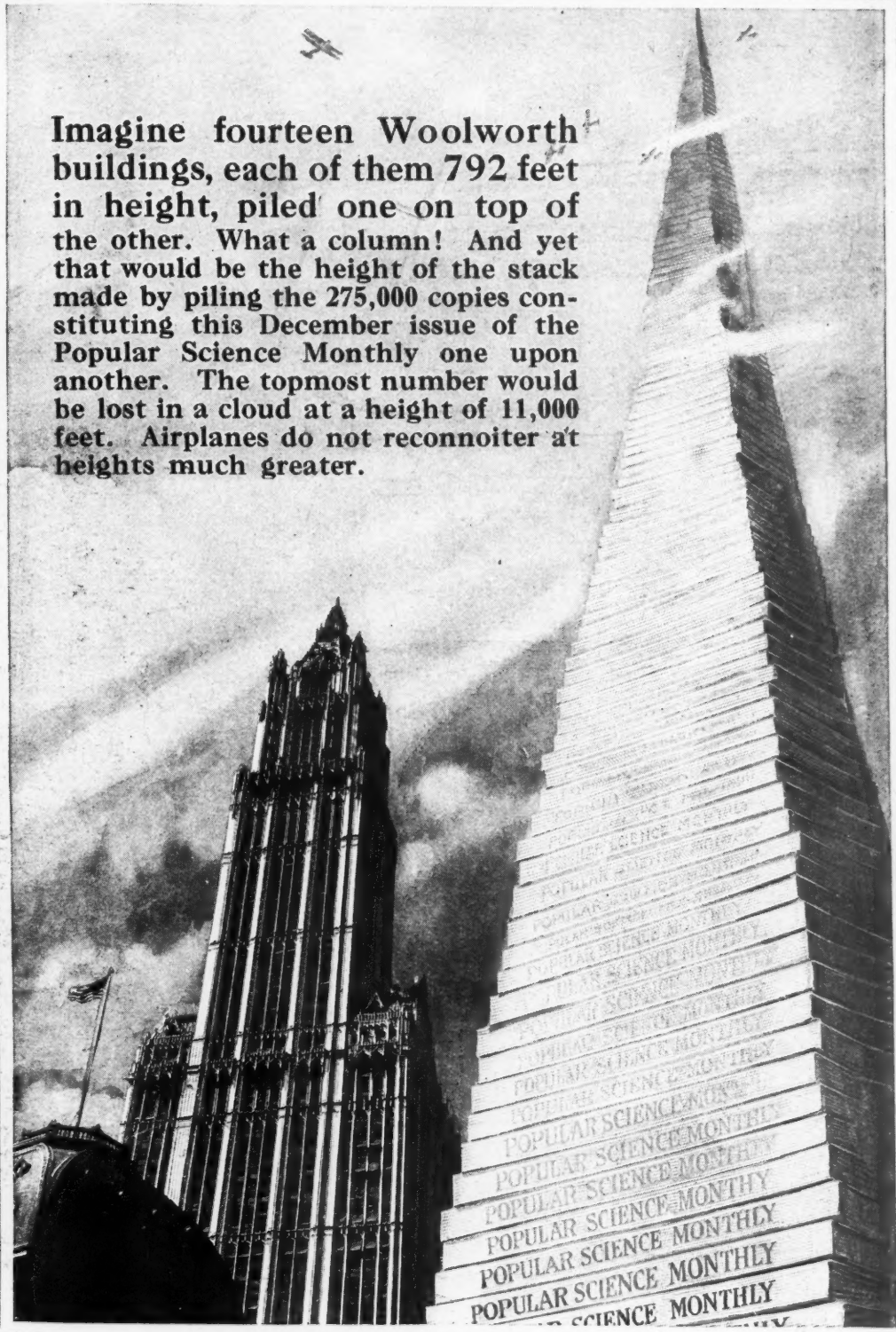
Imagine fourteen Woolworth buildings, each of them 792 feet in height, piled one on top of the other. What a column! And yet that would be the height of the stack made by piling the 275,000 copies constituting this December issue of the Popular Science Monthly one upon another. The topmost number would be lost in a cloud at a height of 11,000 feet. Airplanes do not reconnoiter at heights much greater.



Fishing for Eagles with Airplanes

Why should it not be possible to trail fine piano-wire nets, spread by kite-buoys, between two airplanes connected by a long wire, and enmesh the condors and eagles that soar over mountains?

Popular Science Monthly

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Fishing for Birds of Prey in the Air

The possibilities of a new sport suggested by the killing of birds by flying machines

By Carl Dienstbach

WHAT is the speed of a bird? Mr. H. H. Clayton, of Bluehill Observatory, saw wild ducks flying at a height of 958 feet. He was at the time engaged in measuring the height and velocity of clouds and was able to estimate the speed of the birds as nearly forty-eight miles an hour. Prof. J. Stebbins and Mr. E. A. Fath made careful observations with the telescope and found that birds pass at rates varying from eighty to one hundred and thirty miles per hour and these were minimums. Heavy bomb-dropping airplanes travel at the rate of ninety miles an hour and fast fighters at nearly one hundred and forty miles. Clayton's ducks were poor airplanes, as flying speeds go. Is it any wonder, then, that even a fast bird should be overtaken in its flight by a still faster machine and killed in an aerial rear-end collision?

© Underwood & Underwood

An eagle caught and held fast in the wire bracing of a modern airplane in its flight

It is a wonder that birds are not more often overtaken as was the unfortunate creature which, as our photograph shows, was caught in a military flying machine. With its wide expanse of superposed wings, criss-crossed with stay-wires, a biplane is not unlike a very wide-meshed net. That being the case, why should it not be possible to trail fine piano-wire nets, spread by small kite-buoys between two airplanes connected by a long wire, and enmesh the condors and eagles that soar over inaccessible mountain peaks? That ought to be a fascinating sport. Great birds of prey are fighting creatures. Vedrines found that out some years ago when he flew across the Pyrennes. He was actually attacked by eagles and had to shoot them with a pistol.

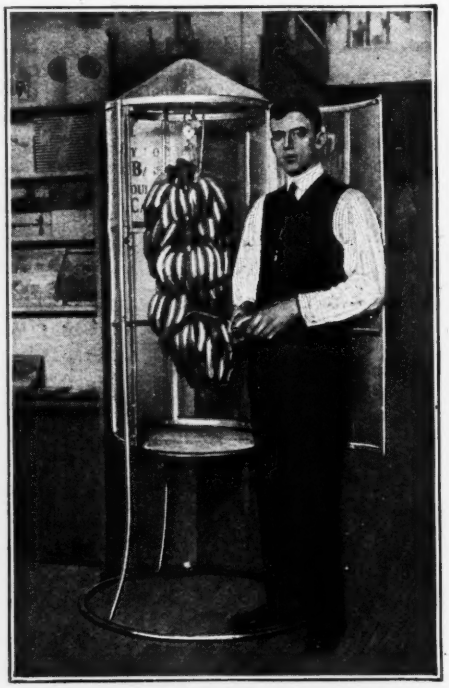
The sport is all the more possible when it is considered how dependable is the modern fast flying machine. Chavez, the first man who ever flew across the Alps, was killed in some unknown manner as he descended into Italy. But the modern flying machine is more powerfully controlled and has a more dependable motor than the airplane in which Chavez made his tragic flight. Witness the daily performances of Austrian and Italian aviators in flying over the dizzy peaks of the Austrian battlegrounds. Vedrines' experience shows that an eagle regards an airplane much as a dog an automobile —something not to be frightened at but to be challenged.

Think, too, of the possibilities of capturing with a net whole flocks of game ducks and geese as well as wild pigeons. Even the use of hook, line and bait, as well as of the net, appears feasible in the air.

Caging the Bananas to Keep Them Clean

CHARLES P. ARTHUR, a grocer in Iowa Falls, Iowa, was impressed by the great need of a method of keeping bananas clean. He saw that flies and other insects crawled all over the bunch of bananas in the store.

After thinking the matter over he designed a case which will keep bananas fresh and clean and at the same time within easy reach of the grocer. This has been patented recently. The case stands a little higher than a man's head, so that the bananas suspended within it are in such a position that they can be cut off easily. The case is made of a metal frame covered with wire netting. This keeps insects away from the fruit and admits air.



A new method of keeping bananas clean. The wire case is of fine mesh and keeps flies and other insects away

Even the Price of Monkeys Is Soaring

WHO would think that the European war would have anything to do with the price of monkeys? Well, it does, and a great deal, too. The price of monkeys has gone up with food, paper, shoes, etc., to the despair of the pathologist and to the sorrow of the hurdy-gurdy man. The causes for the sudden "corner" in monkeys is the closing of the world's principal wild animal market at Hamburg, Germany, and the lack of shipping facilities.

Not long ago the pathologists of the National Public Health Service at Washington, D. C., wanted a dozen South American monkeys for experimental purposes. They appealed to every wild animal dealer in this country, to the zoos, and to the sailors in port, and finally purchased six at $18.00 each.

Keeping the Shampooing Soap Suds Out of Your Eyes

IF Mr. Jones wishes a really comfortable shampoo at the barber's, or Mrs. Smith at her hair-dresser's, let them ask for one of the new types of special shampoo basins shown in the accompanying illustration. The basins are of the ordinary kind, but they have a special horizontal cup-shaped projection at the front in which the head may rest while Mr. Jones or Mrs. Smith leans back in a special chair set about half a foot in front of the basin. The water and soap used in the shampooing operation thus drains off from the hair directly into the basin without running into the eyes.

The upright portion of the device above the top of the basin proper is made into a tank to hold two gallons of soap lotion. This is heated by gas and is drawn out through the faucet.

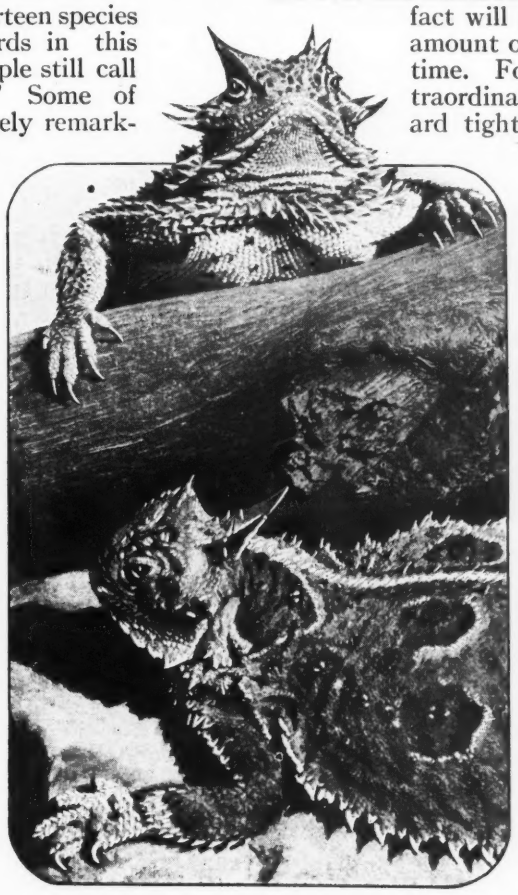
The special shampooing basin has a cup-shaped projection in front in which the head rests

The January POPULAR SCIENCE MONTHLY will be on sale on all newsstands on Monday, December 10th. In the far west on December 26th.

A Lizard That Squirts Jets of Blood from Its Eyes

WE have about fourteen species of horned lizards in this country, and most people still call them "horned toads." Some of their habits are extremely remarkable, but none more so than their ability to send at will a fine jet of blood from either eye. This fact is very rarely touched upon in literature, and the average reader of the life histories of our animals has never heard of this remarkable habit. Personally, I first noticed it in a small species of horned lizard that I captured many years ago in New Mexico; but I have never been able to satisfy myself as to whether the jet of blood was from a vein or from an artery.

Probably the habit has been most frequently noted in the Texas Horned Lizard (called by zoologists *Phrynosoma cornutum*). That species has the widest range of distribution and is found most frequently in captivity. Recently I have had specimens of it alive and have photographed them; a reproduction of one of these photographs is shown here. Blood-squirting is generally indulged in when the lizard is laboring under certain states of excitement. The attack comes on suddenly, at a time when you have the lizard in your grasp. It will suddenly stiffen its neck and throw the head upward, as the eyes bulge from their sockets. In another second you can plainly hear a peculiar hissing sound, followed immediately by the finest imaginable jet of pure blood from one or the other of its eyes. With such force is this squirted that the tiny stream, lasting a couple of seconds, may be thrown to a distance of fully five feet. As the blood strikes, it lands in an array of numerous little spots about the size of a No. 8 shot. Often there are over one hundred of these spots, which fact will give some idea of the amount of blood ejected at one time. Following this most extraordinary operation, the lizard tightly shuts its eyes, resisting all attempts to open them; though, in a very few minutes the eyes, as well as their lids, appear to be perfectly normal again, with a complete subsidence of the swelling.



The Texas horned lizard, which shoots—not daggers—but streams of blood from its eyes

The cause for the blood-squirting is purely conjectural. It is possible that the animal becomes frightened and uses this method of protecting itself from any further handling.

The loss of blood seems to have no special physical effect upon the lizard, or else it recuperates with exceptional rapidity from any resultant weakness.

—R. W. SHUFELDT.

A Little Bit of the Tropics in Our Own United States

ONLY at one place in the United States is there real tropical vegetation. Florida and California have what is called "subtropical" vegetation. In the midst of a desert in the extreme southern part of California is a true oasis. The oasis, Palm Springs, lies two hundred and fifty feet below the sea level. So hot is it there that there is a riot of vegetation all the year round. Enormous fig trees and mammoth grape fruit and oranges are always to be had. The lemons that grow there weigh two and a half pounds apiece. The responsibility for all this may be laid to a beautiful little stream which is fed by the Colorado River and which flows through the oasis only to disappear into the ground at its end.

"Snow of the Penitents" these peaks are called in the Andes. The snow is first blown into waves by the wind, and the hollows are deepened by sunshine

Snow Honeycombs and "Penitents" of South America

THE most bizarre of all forms assumed by snow is probably that known as *nieve penitente.* In the high Andes of tropical Argentina and Chile are found innumerable pointed or jagged blocks of snow or glacier ice, which at a distance—especially in the moonlight—bear an uncanny resemblance to throngs of white-robed human beings. This appearance has given them their Spanish name, *nieve de los penitentes*, "snow of the penitents," and the international name *nieve penitente.* These figures are from four to seven feet high, on an average, though they are sometimes twenty feet.

The origin of "penitents" has been the subject of much controversy. Probably the snow is first blown into waves by the wind, and the hollows are undoubtedly deepened by strong sunshine, but it is not easy to see why the intervening mounds remain. One plausible suggestion is that dust lying on the snow is blown into patches by the wind, and accelerates the melting of the snow beneath it, for the same reason that any dark object laid on a bed of snow sinks more or less rapidly under sunshine, its color causing it to absorb more solar heat than does the snow. An abundance of dust is deposited in mountainous regions from meteors.

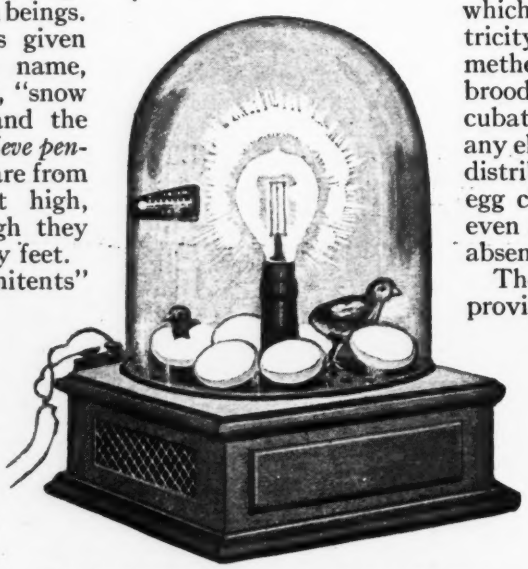
Though the most perfect examples of "penitents" are found in the Andes, more or less similar formations occur in other mountains. Some remarkable snow "honeycombs" approaching the form of *nieve penitente* are produced in hot, dry summer weather among the glacier fields of Mount Rainier. The cups or hollows are a foot or more in diameter, and no water is seen anywhere, as evaporation is rapid.

Hatching Chickens in Glass Globes by Electricity

THERE is always a certain element of risk in hatching chickens in an incubator, for unless the incubator is watched very carefully the temperature may get too low and the eggs spoil.

Electricity may be depended upon more than any other form of heat. A new incubator has been perfected which is heated by electricity. It offers an ideal method of hatching and brooding chicks. The incubator may be attached to any electric light socket. The distribution of heat in the egg chamber is always very even and there is a welcome absence of gases and fumes.

The electric incubator is provided with a glass globe so the chicken fancier may see just what is going on inside the incubator. The heat is given by an electric light which is so regulated that it gives the required heat intermittently. A thermometer is provided.

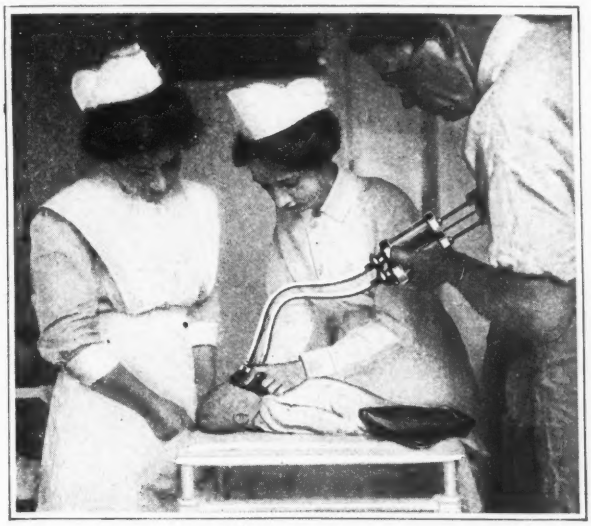


The incubator globe and stand may be connected with any electric light socket

Artificial Respiration for Saving New Born Babies

A DEVICE that is effective in saving the life of new born infants who do not breathe properly, or fail to start breathing at all, is a special lungmotor with a capacity and an operating mechanism suited to the needs of the patients.

A mask pad fits closely over the face, while the operating mechanism is clamped to a table so as to be operated by one hand. The air goes into the lungs of the child at a very slight pressure. Fresh air enters by one passage and the expired air leaves by another so that they cannot mix. The lungmotor can be set at any one of three different capacities for different sized babies.



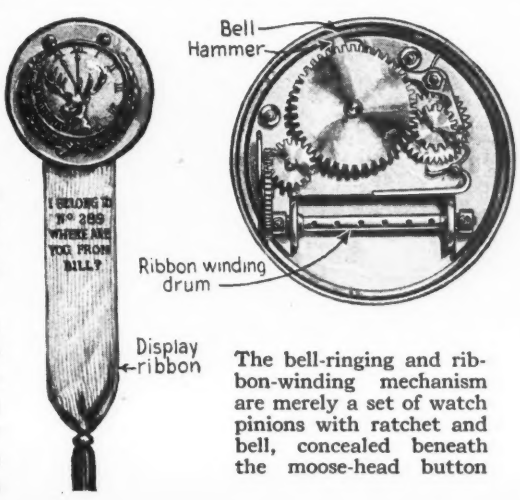
The lungmotor for the smallest human patients. Air enters by one passage and passes out through another

A Badge Which Tells the Story of Your Life

IF you are thinking of attending one of those conventions where every other man you meet is likely to be a brother Elk or Moose, get yourself one of the new explanatory badges. A California man once went to such a convention and got so tired telling others where he came from that he went home and invented the new badge, which tells the whole tale.

This badge looks like any ordinary celluloid button but it does not behave like one. When the curious stranger comes up to interrogate you, his attention is likely to be attracted by the little tassel that depends from your button. He takes hold of this in a friendly spirit and is much astonished to see a ribbon roll out on which are printed the words, "I belong to No. ——, where are you from, Bill?" At the same time a little bell rings merrily. If the wearer of the badge is an Elk, the bell rings eleven times. This mystifying performance astonishes the friendly stranger.

The communicative badge is a very simple device. The bell-ringing mechanism and the winding spring are merely a little set of watch pinions with a ratchet and a bell. These fit into the space on the underside of the button. The ribbon is wound up on a tiny drum, as indicated in the illustration below.

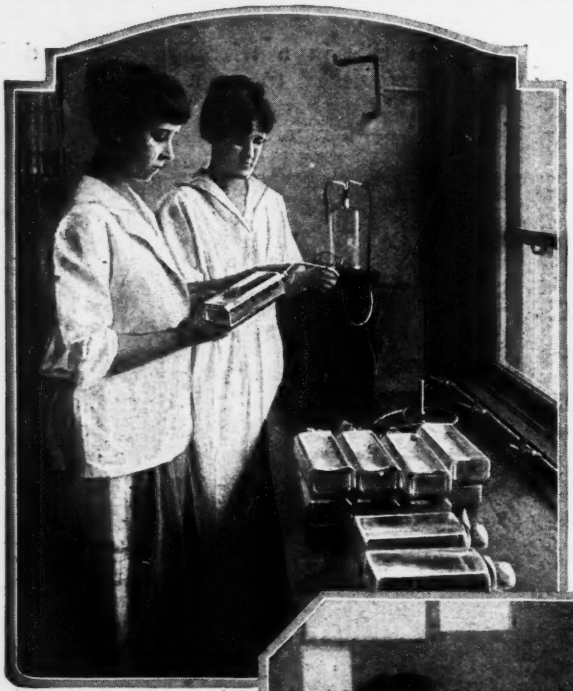


The bell-ringing and ribbon-winding mechanism are merely a set of watch pinions with ratchet and bell, concealed beneath the moose-head button

A Parsec—the Greatest Known Unit of Measurement

A "PARSEC" is a distance that the most zealous pedestrian would hardly care to walk before breakfast. In fact it doesn't enter into the sphere of human operations at all, but it is a handy unit in astronomy. It is equal to 20,000,000,000,000 miles and is the distance traveled by light in 3.3 years. A few of the nearest stars are from one to five parsecs distant from us, but most of the stars that dot the sky are scores or hundreds of parsecs away.

How New York City's Health Department Makes



Preparing the Bacteria

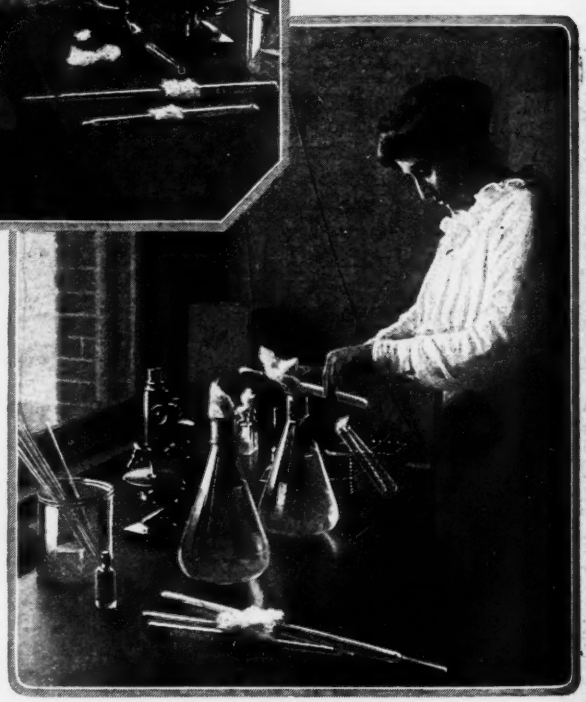
In the preparation of typhoid vaccine the bacteria are grown in the bottles you see on the table. The germs are killed by pouring a salt solution over them. The bottle on the shelf contains the salt solution which is being siphoned into the bottle containing the colony of typhoid fever germs

The Final Step

The finished product containing millions of dead typhoid fever bacilli is poured by means of a siphon into large bottles. The vaccine is kept in a refrigerator until it is needed for use. Note the milky appearance of the vaccine

Transferring the Bacilli

Tetanus bacilli occur in dust, earth and manure. They do not grow in the presence of oxygen and are particularly dangerous if they get into deep wounds. The young lady in the photograph is drawing up tetanus bacilli from the bottom of a test tube by means of a glass tube which she holds in her mouth. Thus the germs are transferred from tube to tube



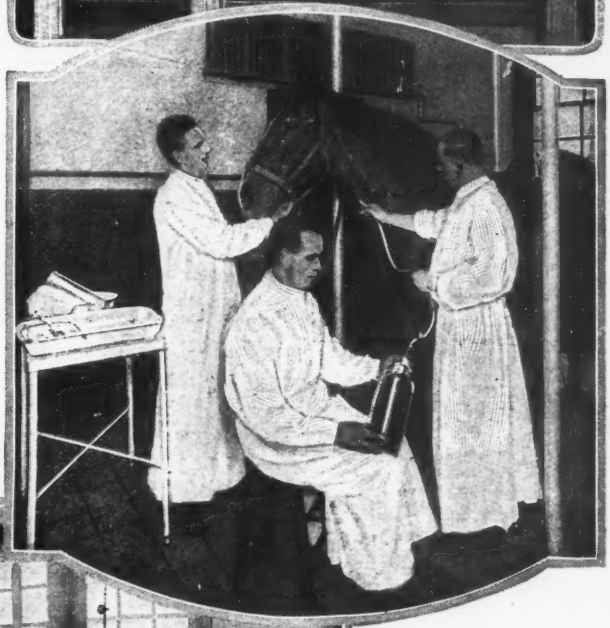
The Resultant Powerful Toxin

Here the large flask is being inoculated with tetanus bacilli. The small wire basket at the right contains test tubes in which are the tetanus germs. The flame which you see just to the right of the flask which is being inoculated is kept burning so that any instrument may be immediately sterilized after exposure

Serums and Vaccines for the United States Army

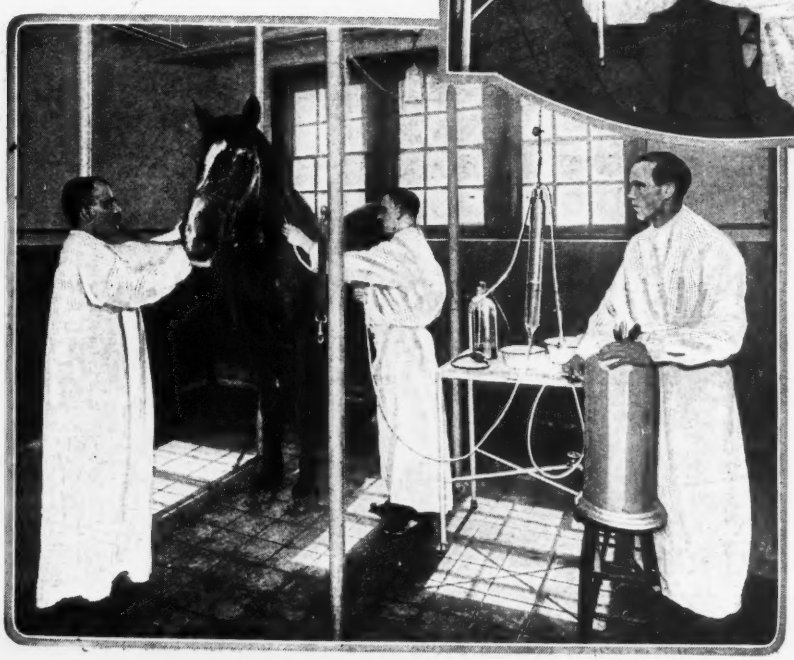
A Glimpse into the "Shop" of the Laboratories

This photograph shows the refrigerator in the Bacteriological Laboratories of the Department of Health of the City of New York, where serums, vaccines and antitoxins are prepared for the use of the United States Army. Much of this material will be shipped to the front. In the containers and bottles which you see on the shelves is $150,000 worth of material. There is enough diphtheria antitoxin to treat 75,000 men, enough tetanus antitoxin for 200,000 men, enough smallpox vaccine for a half million men, enough typhoid fever vaccine for 25,000 men and enough antimeningococcus serum to treat 2,500 men suffering from cerebrospinal meningitis



Bleeding the Horse to Obtain the Serum

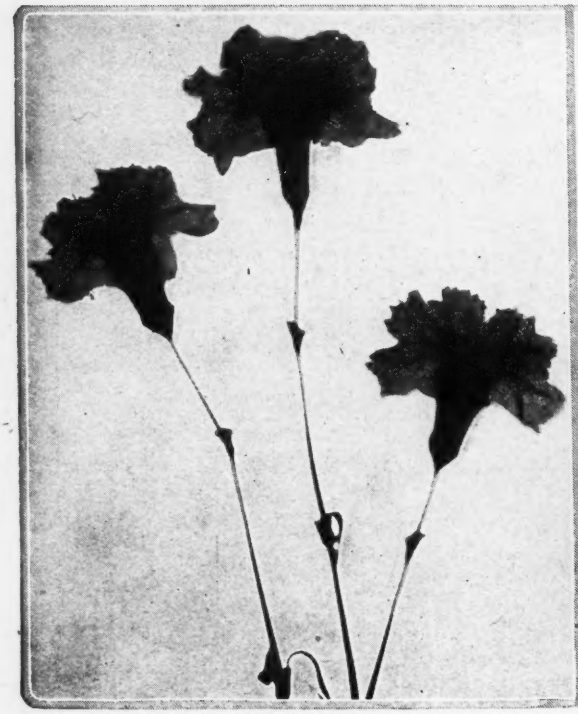
After the horse has been inoculated with the disease poison in gradually increasing doses he is bled and his serum is found to be antitoxin. This is administered to human beings and renders them immune to the disease. The horses are kept in the pink of condition. At periodic intervals they are given a rest. During the rest periods they are turned out to grass. When thoroughly rested, they are inoculated again. Some horses give more antitoxin serum than others. The same horse may be used at several different times for the preparation of distinctly different antitoxins



Inoculating a Horse with Toxin

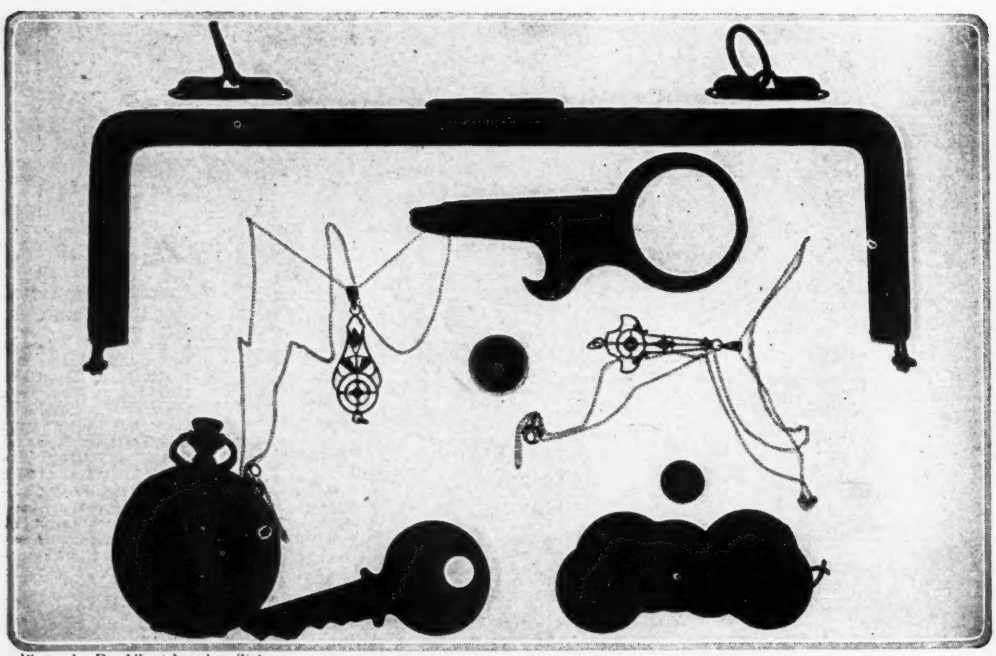
One of the 73 horses in the stables of the Department of Health of the City of New York at Otisville. This horse is being inoculated with diphtheria toxin. Small doses gradually increased render the horse immune to diphtheria. Horses are used in the preparation of diphtheria, tetanus antitoxin and antimeningococcus serum

You Can't Hide Anything These Days. The



This is not a spook photograph of the ghosts of carnations. Nor do the three flowers represent specimens made from extremely thin tissue paper. It is an X-ray photograph of fresh flowers. Note how clear is the tracing of the veins in the petals

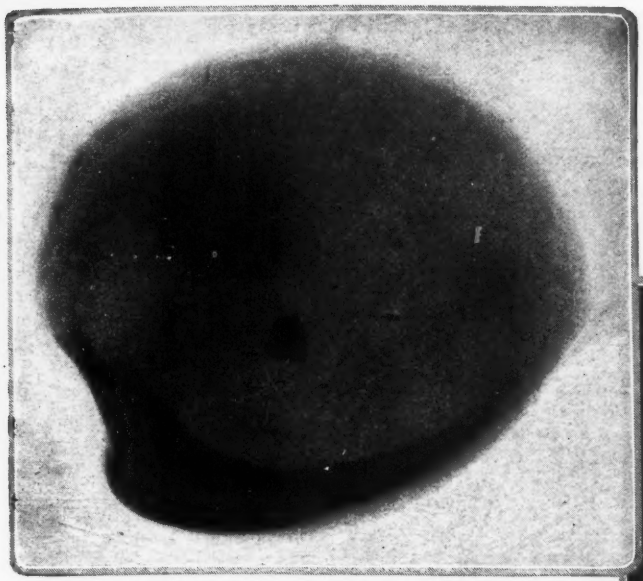
If you suspect your socks take an X-ray picture of them. The tin used to weight them will show up as it did in this picture. These socks are literally tin plated. The fiber is covered with a deposit of tin



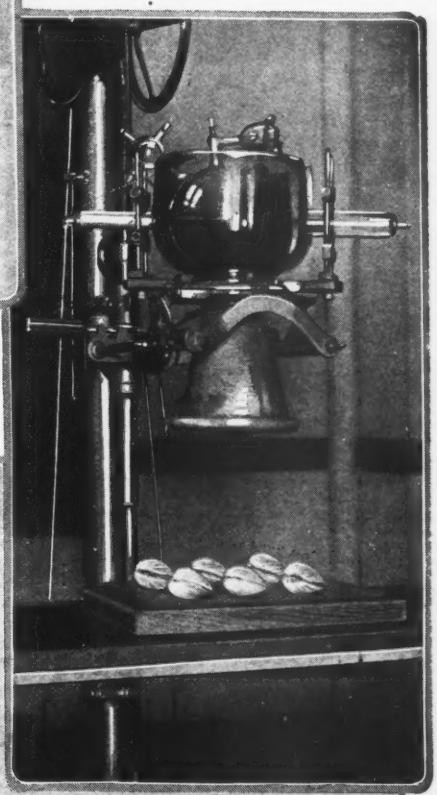
Photos by Dr. Albert Franklin Tyler

How the eye of the X-ray can see everything a lady carries in her handbag. In this bag are a watch, a change purse with a group of coins, a bottle opener, two lavaliers and a key

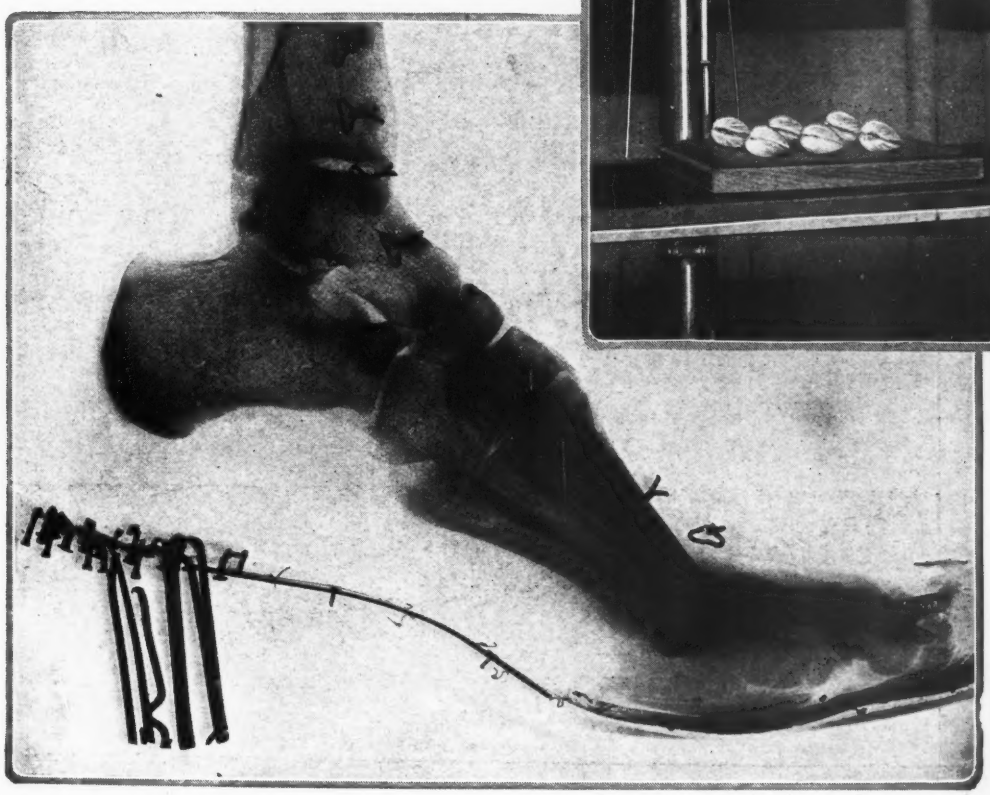
X-Ray Reveals Even the Tin in Your Socks



An X-ray photograph of a mollusk showing a pearl under the shell. The pearl looks black in the picture, not because it is black, but because it is opaque. The other portion of the photograph which shows up black is simply the shadowed section

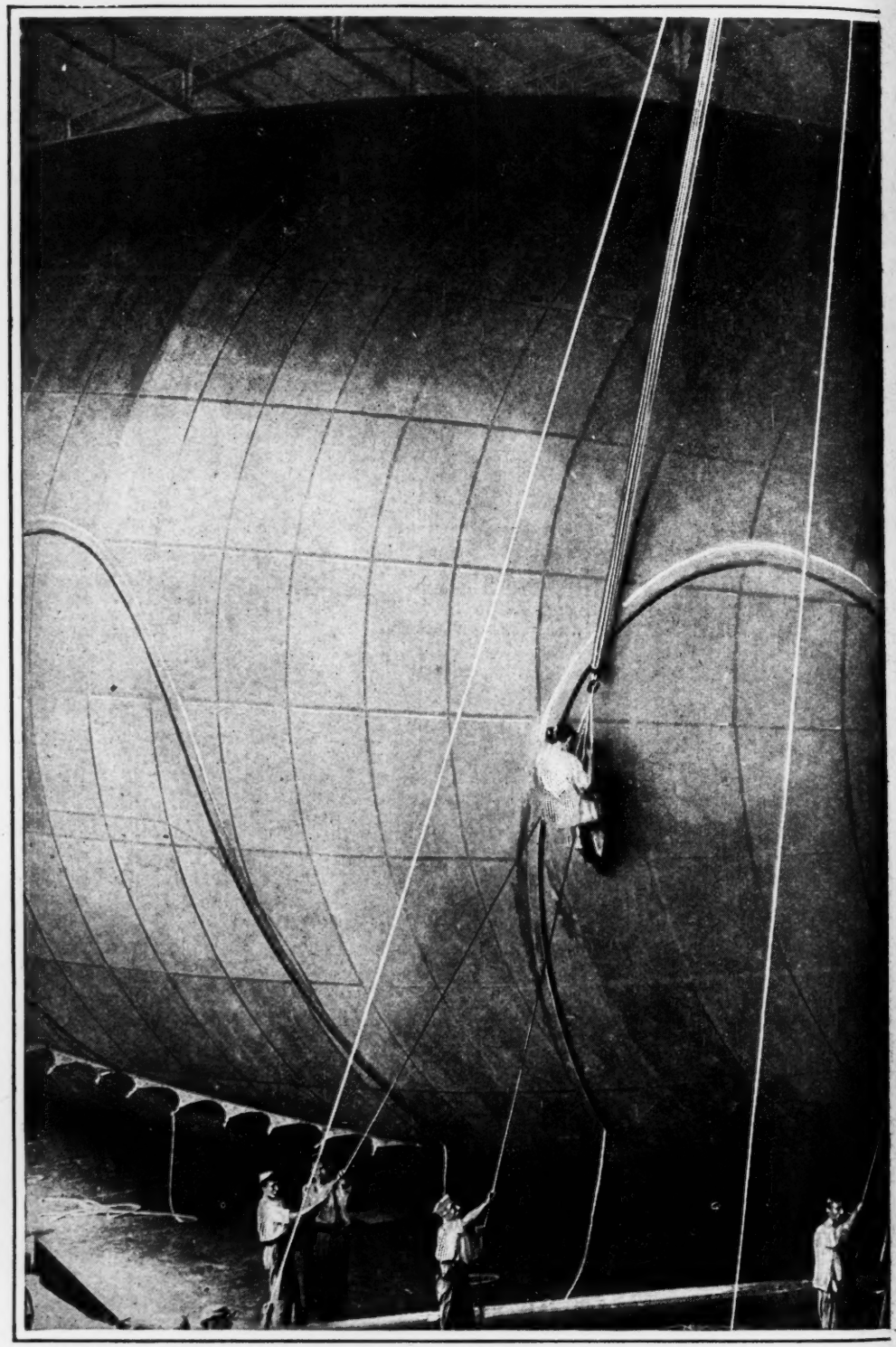


A group of mollusks being X-rayed to find out whether or not they contain pearls. The shell-fish are resting on the photographic plate directly under the lens of the X-ray apparatus



In a photograph of the shod foot the X-ray shows the bones of the foot, the metal eyelets for the laces, the nails in the heel and the wires and nails around the sole

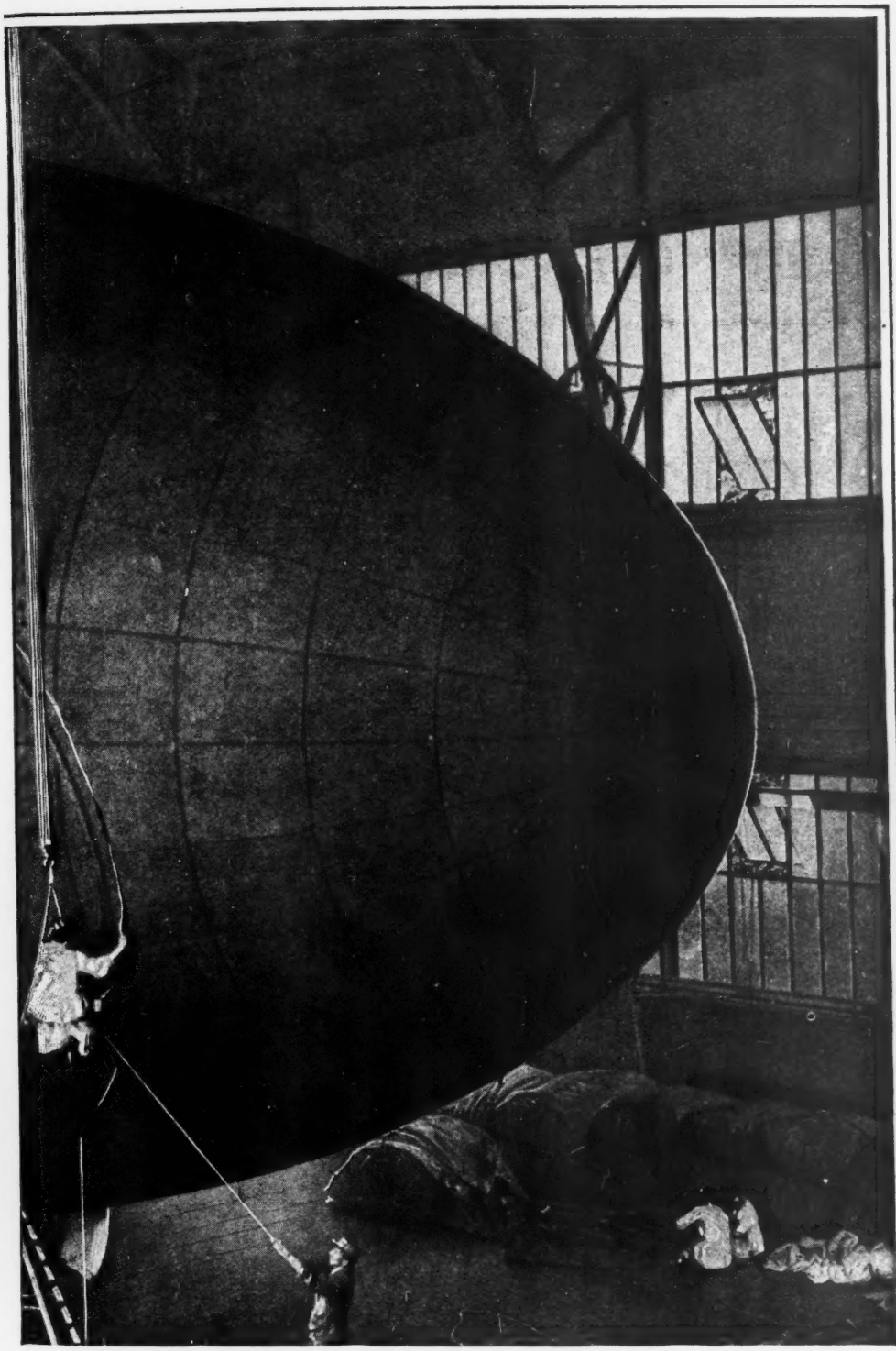
French Women at Work on an Observation



French Official Photo

Even airship factories and sheds employ women. Here are some slung in "cradles," engaged in fastening bolt-ropes on the fabric of an observation-balloon. As soon as such a

Balloon Near the Western Battle Front



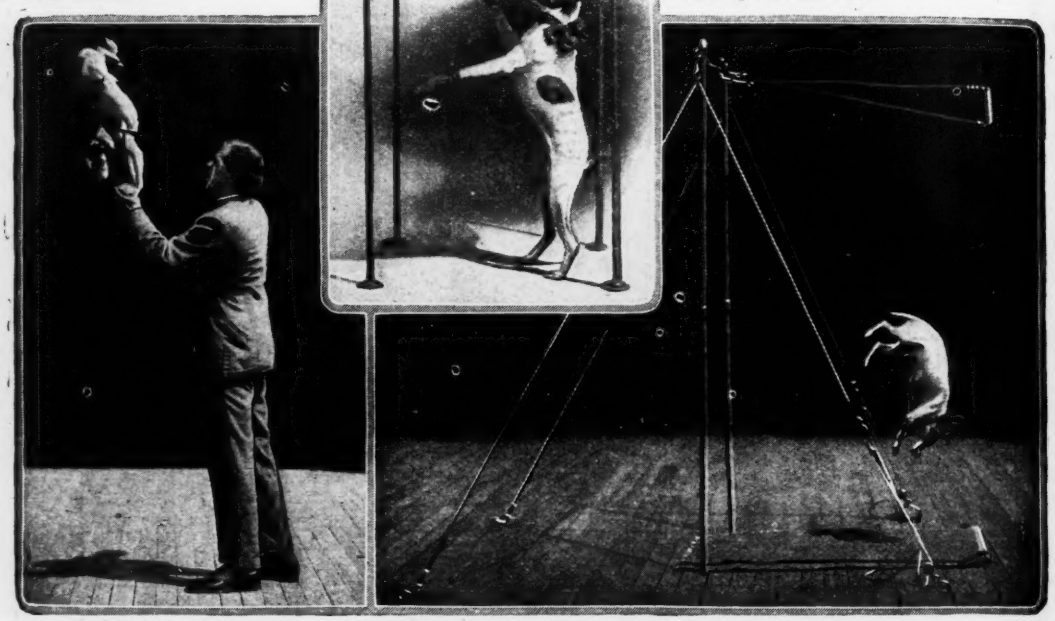
balloon appears it becomes a shining mark. It rarely stays up long undamaged. Hence these women are often called upon to make repairs within sound of the big guns

Four-Footed Gallery Gods That Love A Curtain Call

Enter the heroine in laces and soft satins

In center picture: Getting in trim for a boxing match. He punches the bag with both his paws and his nose and even with the back of his head occasionally

Photos © Press Illus. Serv.



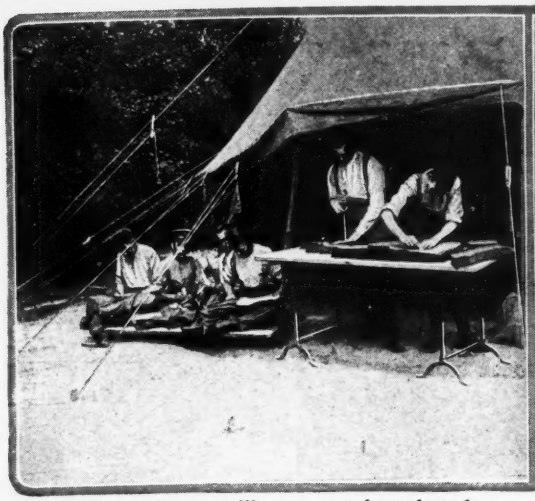
This little dog has lots of confidence in his master. This trick requires a very good sense of balance

Many a human acrobat would envy the small dog shown above his ability to perform on the trapeze

Mr. and Mrs. Canine take the baby for an airing. Notice the proud expression on the faces of both papa and mama as they pose

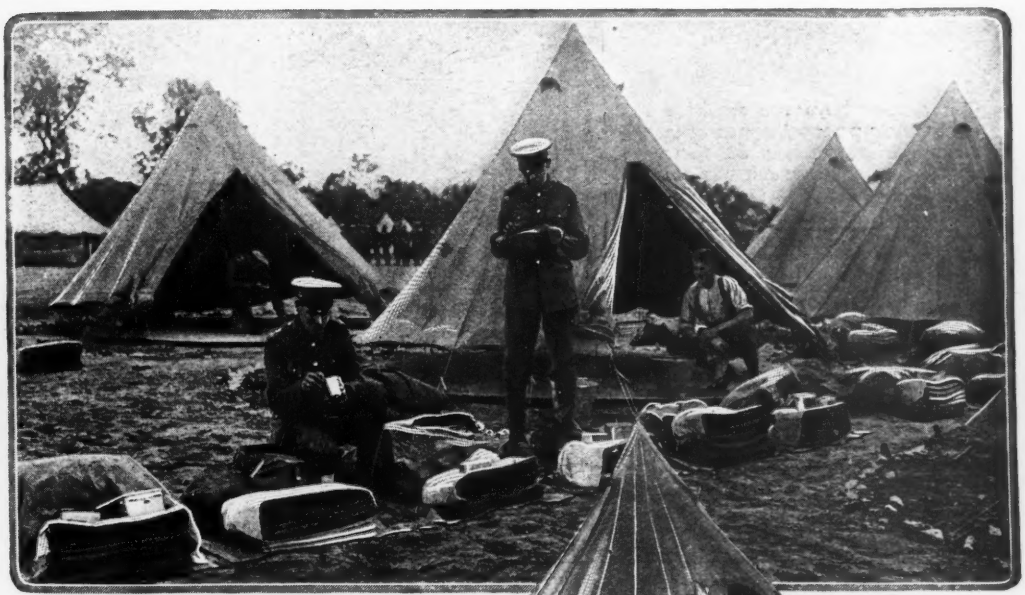
A boxing match between two vaudeville stars. They are evenly matched as to weight and skill and handicapped as to clothes

Making Patches for Pershing's Boys



Khaki uniforms will wear out but that does not bother the Allies or their army tailors

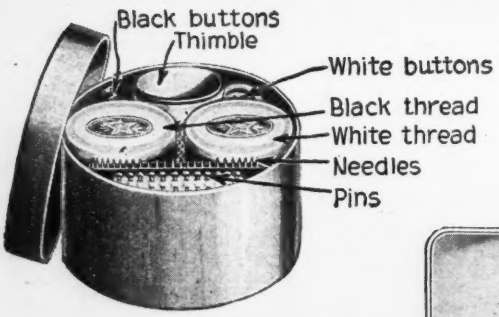
Broken shoes are not discarded. They are soaked, scrubbed, and mended like new



When the soldiers' kits are all repaired and ready to be returned they are carefully examined by special inspectors to see that everything is shipshape

Bicycles and machine guns are never scrapped while any part of them remains. The army smiths make them over into new ones

Comfort for Our Soldier of Many Ingenious Minds. Kits Containing Almost Buttons and Brushes, Soap,



No one can take mother's place in sewing on buttons, but with this little sewing kit on hand, it is as easy to sew on a button as to depend on a thong of dried grass. Pins are also provided in the kit

Our soldier boys are sensitive about their personal appearance and pride themselves on their neatness after the rough work is done. Promotion, too, is often influenced by such things, it is said

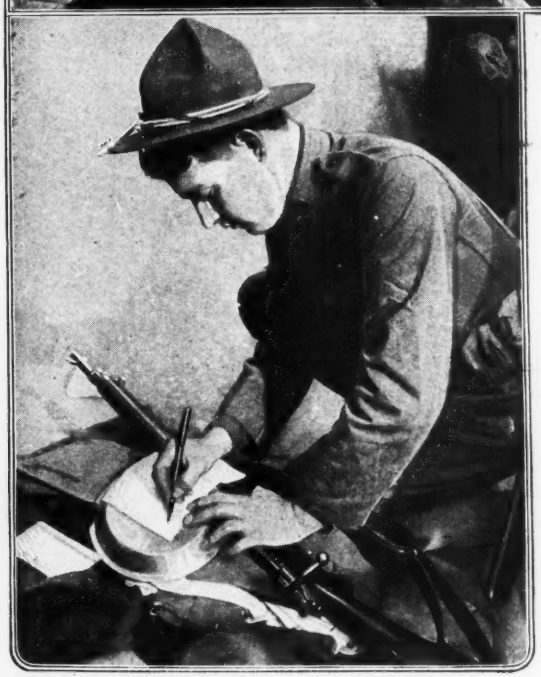
The business of sewing up a tear is almost as strenuous as the military drill for which this soldier is grooming himself

It is part of a typical American soldier's hygiene to keep his nails cropped and cleaned, however rough his work may be

Boys Has Been the Objective There Are Now Compact Every Necessity, Including Powder and Stationery

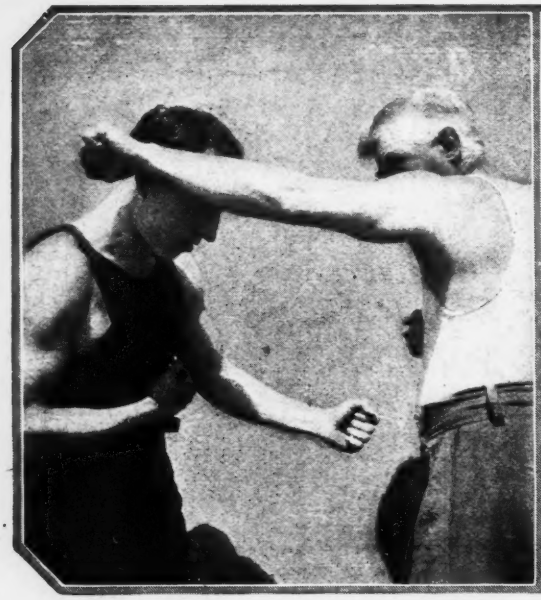
A shave is a shave whether at home or in camp, provided you have a good safety razor

This case holds stationery, a steel mirror, extra buttons, and adhesive plaster and every convenience for the daily care of the teeth and nails

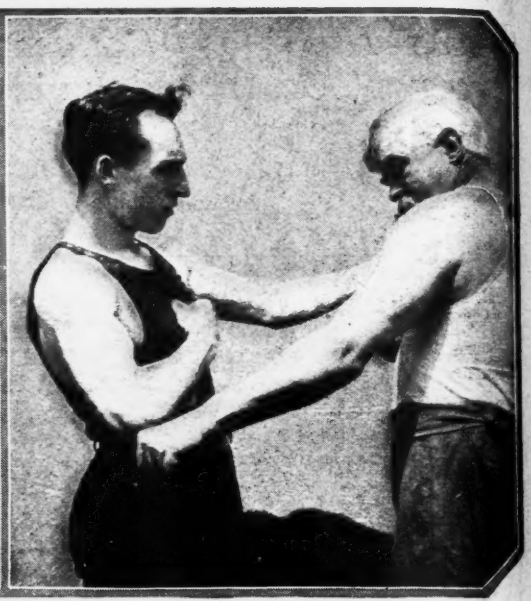


The fountain pen takes its place with the sword in our boys' equipment. Anything will serve for a desk—even a tin pan

Talcum powder is a necessity to the infantry, whose heavy shoes and long marches are hard on the feet

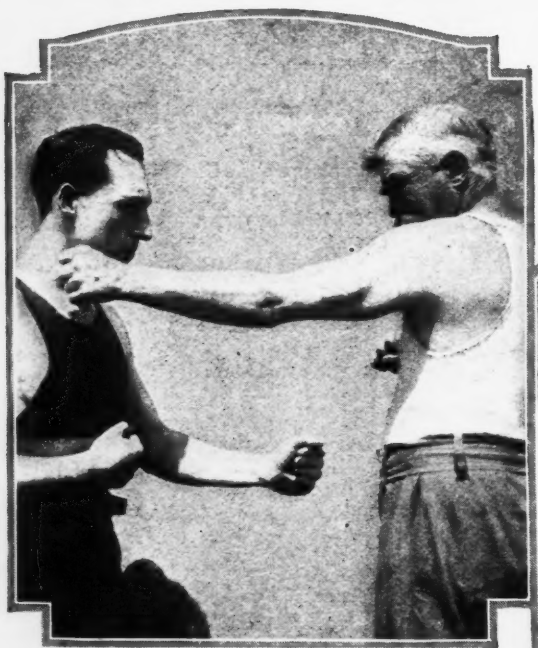


Sometimes what is meant to be a smart left swing at the head of an opponent results in a badly broken forearm for the swinger



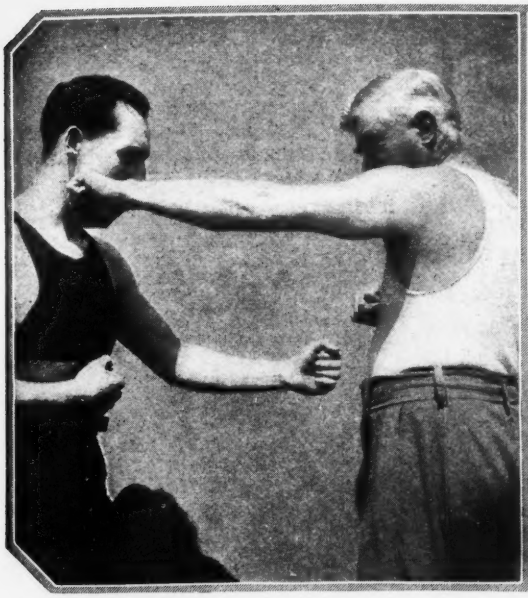
Watch your blow, boys, when you land a left swing at the body. The other fellow's elbow may drop suddenly and break your hand

If you're in the army you'll
De Witt Van Court, boxing with
how to do it without hurting
taken for the Popular Science
former boxing instructor of



You can get into lots of trouble with that ambitious left arm. A left hook at the head like this may easily mean a broken thumb

Do you want to land that hook? Take a good look at this photograph, memorize the position of Van Court's hand and go to it



A way to swing at your opponents' head with your right and regret it afterwards while you are nursing a broken forearm

And here is just the sort of good right hand punch that might have put him out for the count and never would have hurt you

box. The famous instructor, young Vance Veith, shows you yourself. These pictures were Monthly by Carroll Van Court, the Pasadena Athletic Club

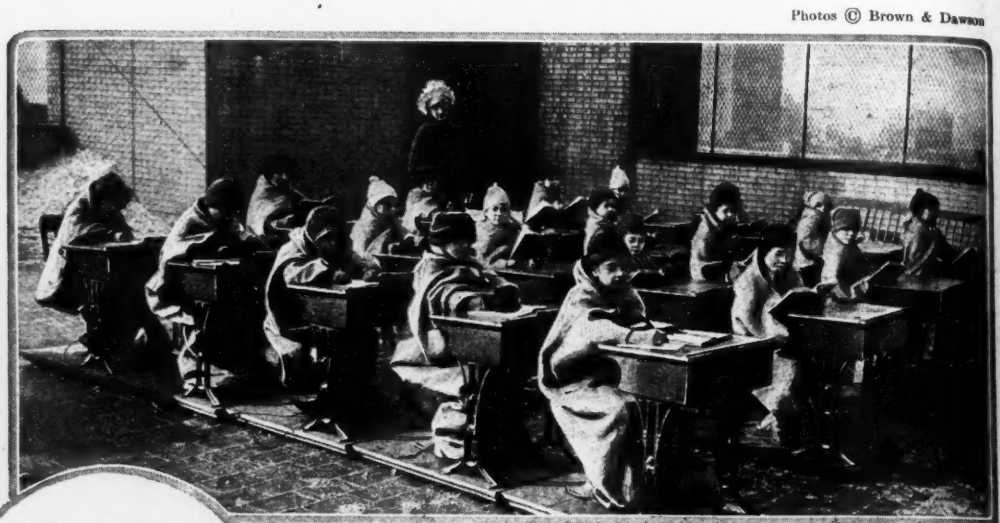
When you want to lead a straight left, look at this picture before going into action. This illustrates just what you should not do

And then examine closely this photograph on the left, for this shows the correct position for all straight lefts at the head

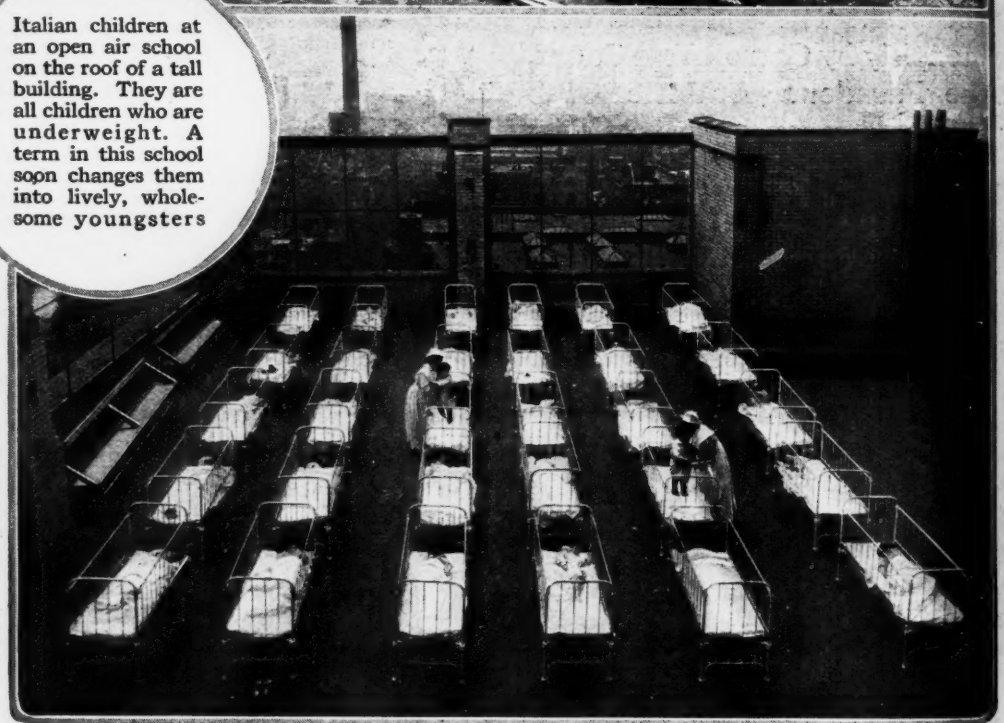
How New York City Secures

In the congested districts of New York City many families live in such crowded quarters that the children never get enough fresh air. The Children's Aid

Photos © Brown & Dawson



Italian children at an open air school on the roof of a tall building. They are all children who are underweight. A term in this school soon changes them into lively, wholesome youngsters



Small children sleeping in the open air on the roof of a New York day nursery where they are cared for by special attendants and trained nurses while their mothers are out working

Red Cheeks for Its Anemic Children

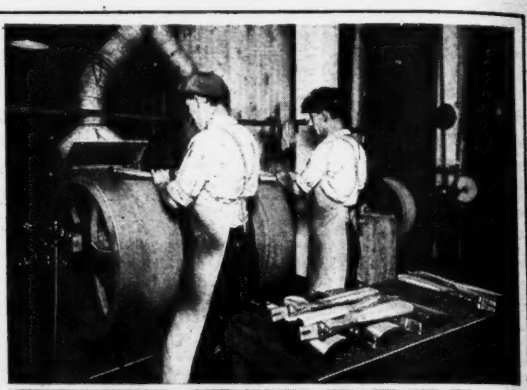
Society has established an open air school and a day nursery where weak, underweight children are taught in the open air. They gain rapidly in general health and strength on the sunny roofs, are not taken away from their families and keep up with their grades in the public schools

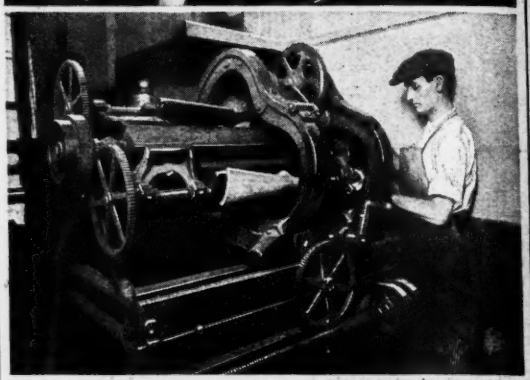
Crippled children have a school away up above the housetops on a sunny roof. They are taught crafts such as jewelry making and embroidery. Between classes they take a nap in the fresh air

Children of the Italian school gaining health and strength by a long rest right out in the air and sunshine. First they have classes, then a good midday meal and the outdoor nap

Steps in the Making of Rifles and Bullets

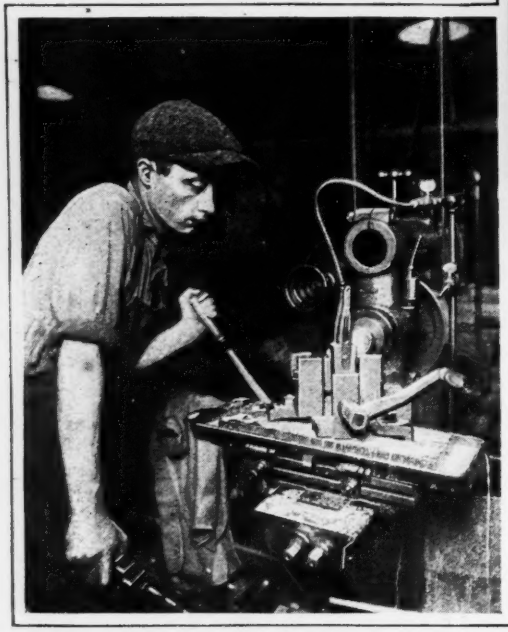
James, here, is busily engaged in assembling the butt. He slips the wooden butt-stock into place and starts the metal parts into the shoulder butt by hand





The butt-stocks are roughly formed in the carpenter shop. Before being polished, they are cleaned on large buffing wheels like those in the top picture at right

In center picture at right: Grinding the butt-stocks so the metal parts will fit accurately. Two butt ends are inserted and ground in the machine at one time

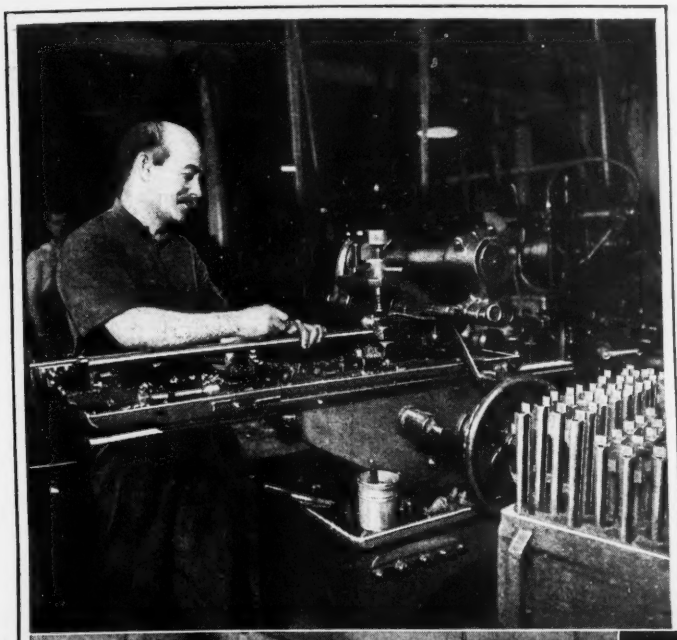


Photos © Press Illus. Serv.

Above: Stock butts being finished and polished. They are varnished, dried and rubbed down with emery cloth. This process is repeated as often as may be considered necessary to secure the final polish, which must be very high and of lasting quality

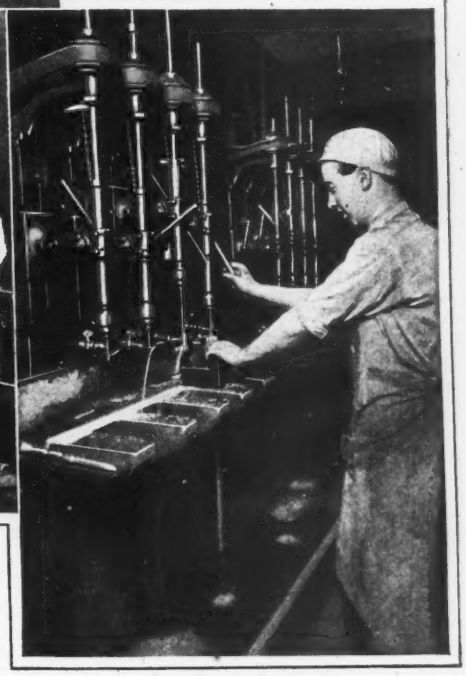
Now for the wonderful work on the magazine. Cavities and slots are cut out of solid metal by a modern milling machine with high-speed rotary cutters. The milky fluid running over the table is called the cutting liquid which prevents the tool from over heating

for the Use of Uncle Sam's Boys "Over There"



Barrels being finished on the outside. Bob is here feeding a barrel into a machine which trims it to size and finishes the outside so that it is exactly concentric to the bore

The cavities in the breech end of the barrel vary in size. The barrel is held in a fixture while Pete (below) uses the different drills on it. The piping delivers lubricating oil



Photos © Press Illus. Serv.

Adjusting the telescope sights on rifles. The rifle is first sighted on a target, then the telescope is attached to the barrel and trained on the same target

Gathering and assembling the various parts is bench work. John, shown on the left, takes great pride in his work for it calls for almost as much skill as does the assembling of a watch

In recreation hours, Fritz, the dummy, has bouts with the goat, the mascot of the camp

The instructor in bayonet practice manipulates the dummy's bayonet

How a Fighting Dummy Teaches Men to Use the Bayonet

THIS war is not being fought entirely at long distance. Hand to hand encounters in which the bayonet is used are something every soldier must be taught to expect. Hence, straw dummies have been used for bayonet practice ever since the war began. But the best dummy thus far produced is one made by Company Sergeant-Major McKenna, of the British Army Gymnastic Staff.

His realistic dummy is mounted on wheels and is made to retaliate to bayonet charges by wielding a stick which it grasps in its hands. The instructor in bayonet practice manipulates the dummy's bayonet from behind the figure.

When the boys themselves get tired of exchanging bayonet blows with Fritz, as the dummy is called, they let their mascot have a bout with him. This mascot happens to be a goat of a belligerent nature. He takes delight in bucking the dummy.

Keeping the Trains from Being Blown Off the Tracks

THERE is a stretch of railway along the west coast of Ireland where it was formerly not an uncommon occurrence for the trains to be blown from the rails by the winds from the ocean. These disasters are now prevented by the use of an ingenious form of anemometer which rings an alarm-bell when the velocity of the wind reaches 65 miles an hour. Each station on the line keeps on hand a stock of movable ballast, a ton of which is placed aboard every car arriving at the station after the bell sounds.

The Largest Ball of Twine that Has Ever Been Wound

SEVENTEEN years ago, H. L. Springer, of Richmond, California, decided to make a large ball of twine. He is now the proud possessor of what he thinks is the largest ball of cotton twine in the world. Other large balls of twine have been wound by persons who had a great deal of patience, but they generally have been made of all sorts and kinds of string. Mr. Springer's ball is made of cotton twine only. Almost every yard of twine in it came from laundry bundles delivered at his laundry.

A ball of cotton twine that weighs 80 pounds. There are 40 miles of twine in it, saved during seventeen years

The ball has grown to such proportions that it is difficult to handle it. It weighs 80 pounds and measures about two and one-half feet in diameter. The string in it would stretch a disance of forty miles.

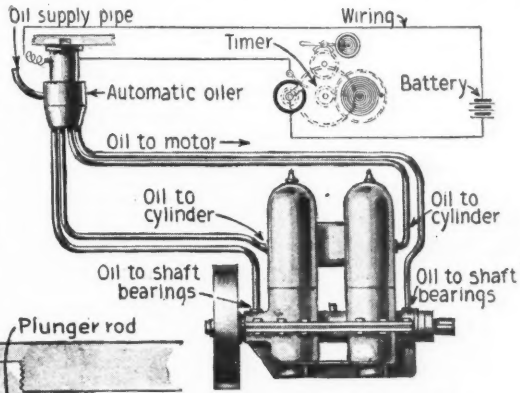
Needless to say, Mr. Springer is not worrying over whether or not the war will cause a shortage of twine. His ball will supply him for many weeks, if he should be forced to use it in his business.

A New Way of Oiling Machinery by Electricity

INSTEAD of going over machinery with an oil can in hand it is now possible to oil it automatically. George M. Rogers, of Chicago, has invented an oiling apparatus which is operated by electricity and which can be put to work at any time by setting the mechanism just as one would set an alarm clock.

The oiler has a cup with an oil-feed opening in the bottom. An oil-feed pipe is connected with the cup and a plunger rod is so arranged that it gives vertical movement in the cup. A valve fitted at the lower end of the plunger fits the opening when the plunger rod is lowered. A guide pin extends downward from the valve and a gasket adapted to bear on the bottom of the cup when the plunger is lowered is arranged under the valve. The valve and plunger are operated by electricity.

If it is desired, an electric light may be included in the circuit which operates the oiler so the attendant may be able to watch the operation.

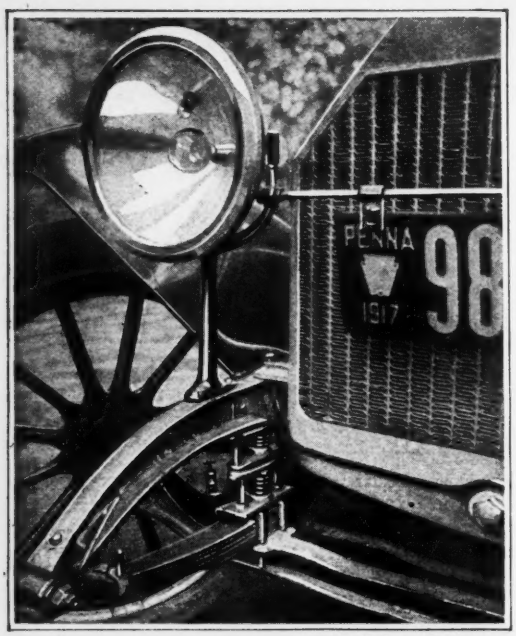


Details of the device for feeding oil automatically to machinery

A derailing device makes it possible for a single operator to remove the grinder from the path of traffic

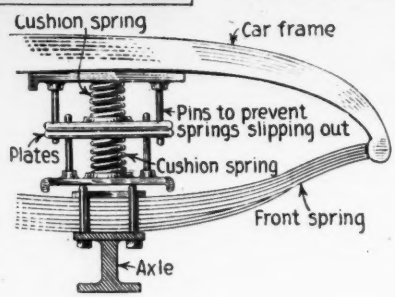
A One-Man Rail Grinder Which Does Not Interfere With Traffic

HERE is a one-man rail grinder recently put out for machining off the surplus metal from a solidly welded joint on a street railway line or for grinding low and pounded joints, corrugations, curves, etc. The practice of substituting the solidly welded joint for the mechanical or bolted joint on electric railway systems is now becoming very common. It decreases the electrical resistance at the joints, saves power and prevents the leakage of current to nearby water and gas mains. Besides it eliminates the vibrations due to inequalities in the heights of adjacent rails. Whether these joints are welded by the thermit, oxyacetylene, or electric process a shoulder of surplus metal is left which must be machined away. But more important than this is the use of the rail grinder in removing the corrugations or ridges which the incessant wear and pound of swiftly moving cars are constantly producing in the rails. Just why these corrugations appear no one has been able satisfactorily to explain, but in order to eliminate the destructive vibrations which they transmit to the rolling stock as well as to prolong the life of the rail, their removal is absolutely essential.



Inserted between the front axle of an automobile and the frame of the car, the two springs are carried between narrow plates

Two vertical pins extend through concentric holes in the two center plates so that the springs cannot be jolted out of place



and then I will send for a new spring. It will cost me two or three dollars to be towed home. Go ahead and weld it for me." And so Scott would sadly weld the spring and charge one dollar and the driver would go away satisfied.

For all that, he did not dismiss the subject from his mind. Finally he hit upon the idea which we illustrate.

Inserted between the front axle of an automobile and the frame of the car, the two coil springs are each carried between two narrow plates. The upper plate of the top spring bears against the under side of the frame and the lower one against the top plate of the lower spring while the bottom plate of the latter bears against the top of the main car spring. Each set of plates has two vertical pins which extend through concentric holes in the two center plates as shown, so that the springs cannot jump out of place as they take up the bound and rebound of the car spring.

If you have Scott's device in your toolbox and a spring should break, you can make your own repair on the spot. You will not require the services of a blacksmith or someone to tow you home. You continue your trip just as if nothing had happened.

A New Way of Cushioning the Front Spring Action of an Automobile

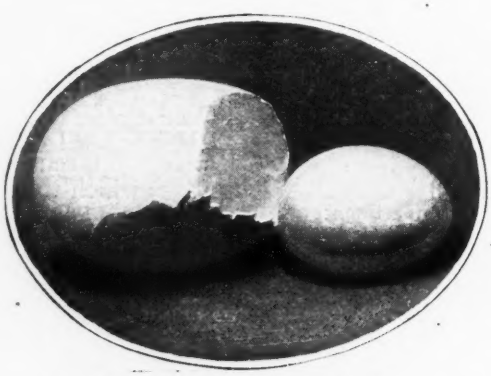
WALTER F. A. SCOTT of Doylestown, Pennsylvania, is a blacksmith who has seen many a broken down automobile in his time. Often a driver would bring his car to him and point sadly to the broken leaves of a spring which he had attempted to repair temporarily with a block of wood.

Scott knew that after a spring is welded, it is not to be depended upon. He would offer to make a satisfactory job but invariably he would be met with the reply: "I only want to get home

How Did One Egg Get Inside of the Other?

TWO eggs in one alongside, are not uncommon and are known as double yolked. But the eggs found by Mrs. Grace Lee Smidt of Sound Beach, Connecticut, are out of the ordinary because the interior egg has a shell.

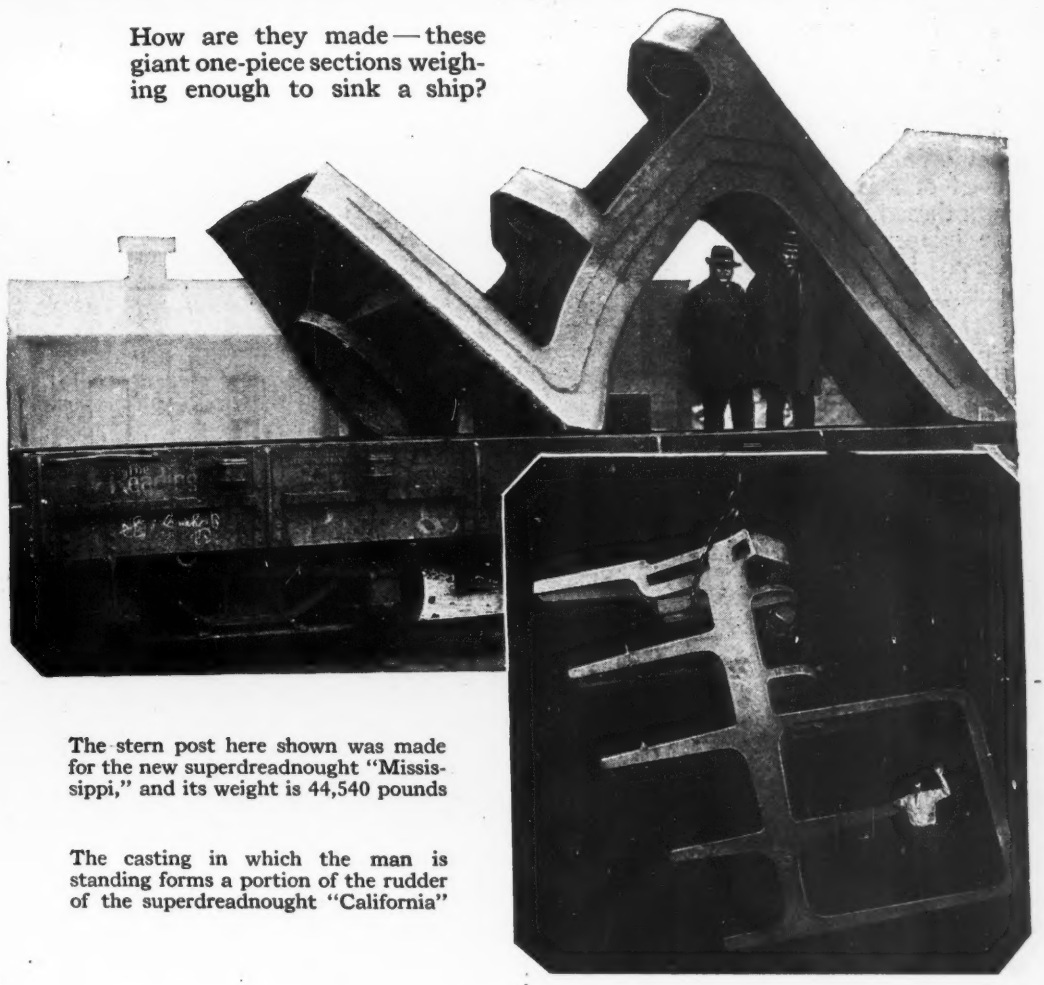
Diminutive eggs are frequently laid by hens, especially in the "last of the litter," as the farmer would express it, and it is evident that in this double-egg production, the process of forming a larger egg continued as if the shell had not been deposited on the smaller.



A perfect egg of good size formed inside of another perfectly shaped egg

Steel Castings for Modern Dreadnoughts

How are they made — these giant one-piece sections weighing enough to sink a ship?



The stern post here shown was made for the new superdreadnought "Mississippi," and its weight is 44,540 pounds

The casting in which the man is standing forms a portion of the rudder of the superdreadnought "California"

THE extent to which steel enters into the construction of the modern battleship is realized by very few. Besides the tons of steel plates which form the hull or hold of the ship itself there are some very large steel castings. The two illustrations here shown are excellent examples.

In the two castings illustrated there are over 90,000 pounds of steel and both of them enter into the stern or rear part of the ship. It would seem almost as though these would cause the vessel to stand on its end or sink it.

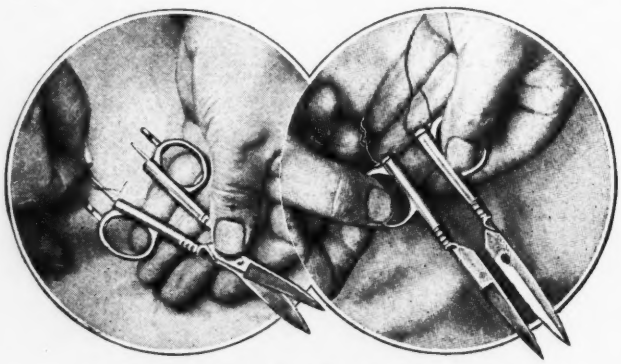
One of these is the stern frame or stern post, and the other is the rudder frame. The rudder frame is attached to the stern frame, which of itself constitutes the backbone of the vessel's stern. The stern post here shown was made for the new superdreadnought "Mississippi," and its weight is 44,540 pounds. The other casting, the rudder, was made for the new superdreadnought "California," and its weight is 50,500 pounds.

The part of the casting in which the man is standing forms a portion of the rudder proper while the large lugs above fit on to the corresponding lugs shown on the stern post in the car.

How were these castings made? A large sand mold of several sections had to be made for each one, and each part was dried out completely before the molten steel was poured in. The actual amount of metal poured in each case was over sixty-seven thousand pounds for the rudder frame, and over fifty-nine thousand pounds for the construction of the stern frame.

Storing Needles and Thread in the Handles of Scissors

NO man likes to be bothered with the usual sewing outfit. But there come times when every man away from home feels the need of needle and thread. If he happens to have in his pocket a pair of the scissors shown in the accompanying illustrations he is fortunate. For although the scissors are small enough to be carried in the vest pocket, they contain storage places for needles and thread ready for use.



In each of the rods of the handle is a compartment for holding needles and thread

The handles are hollow, and within them the sewing implements are kept. In one of the rods a tiny bobbin is stored, on which is wound sufficient white and black thread to serve in several emergencies. In the other handle is a compartment for needles—self-threading needles, so that it is no task to thread them on a fast-moving train or in a poor light. The hollow handle rods are closed by a small cap operated by a spring trigger.

A screw holds the two blades of the scissors together and permits of their being taken apart so that either blade may be used separately, as for ripping seams.

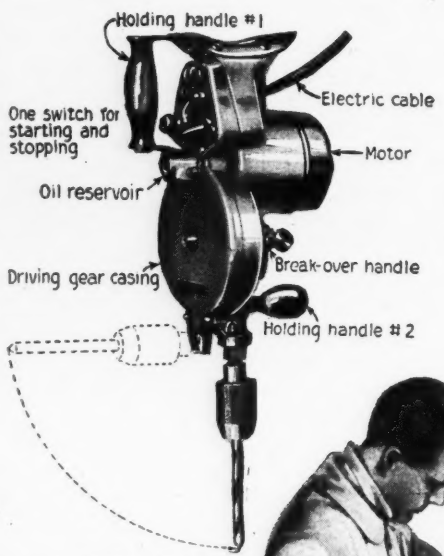
The scissors should be kept in a leather case so that the points may not injure the lining of the vest pocket where they are carried.

A Three-Purpose Electric Drill for Automobile Repairs

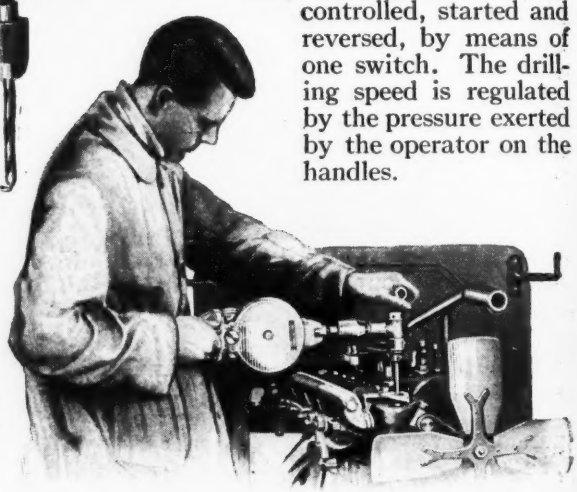
BY adding two small attachments, the electric drill illustrated below may be transformed in a few seconds to a valve-grinding tool or an emery wheel for sharpening bit tools and the like.

The drill has another distinct feature. The main spindle carrying the chuck may be thrown over at right angles to its regular position, the squared portion of the spindle engaging the jaws on the bottom of the drill housing and thereby preventing the drill from turning, and allowing the chuck to be tightened by hand as desired. This saves much time when different-sized drills must be used alternately, particularly the time usually lost in looking for the chuck wrench or key.

The drill may be driven by current from the ordinary lighting circuit and controlled, started and reversed, by means of one switch. The drilling speed is regulated by the pressure exerted by the operator on the handles.



A small electric drill which serves three distinct purposes



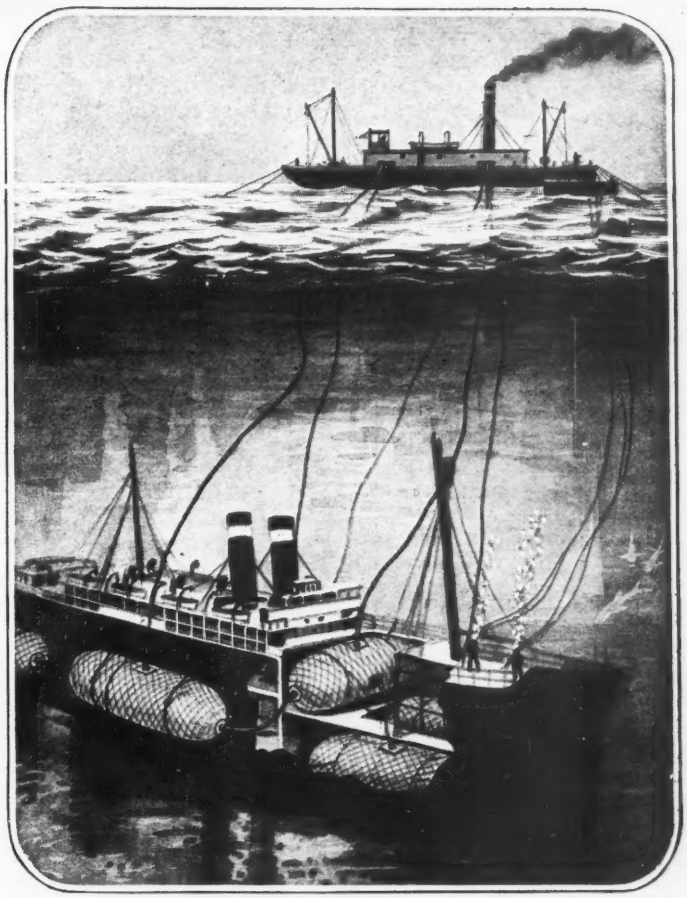
With one attachment the drill may be transformed in a few seconds to a valve-grinding tool

Making Comfortable Quarters for the Pet Snake

ONE of the special treasures of the average country boy is likely to be a pet snake, and one of his special problems is how to house it safely. According to L. S. Crandall (*Pets*, Henry Holt & Co., New York) "no fixed dimensions need be set. Snakes are not particularly active creatures, and the cage need be only large enough to give its occupants room to move about freely. For the smaller species large glass aquaria, fitted with wire tops, make excellent homes and have the added advantage of plenty of light. If the cage is to be of wood, the front should be of glass rather than of wire, as snakes are likely to rub against the latter and injure their mouths.

"It is always wise to make the door of such a box in the top, which makes it possible to care for the captives with a minimum of disturbance. This door, or the entire top, may be of wire netting to allow ventilation. The furnishing of the cage may be varied according to the needs of the inmates. In some cases it is better left entirely plain. In others the bottom may be covered with sand, loam, dry leaves, moss or rounded pebbles. Many snakes will take advantage of a shelf placed midway between floor and top, and others will drape themselves among branches set upright in the cage.

"Water should be provided for all species, and water snakes should have a good-sized bath, in which they will often be found immersed. Cages should be cleaned frequently and all excreta removed with care. Snakes are fond of sunshine and cages should be placed so as to admit it, but care must be taken to avoid overheating. It is important that the cage be absolutely dry, for snakes of most species will not thrive in damp quarters or even in a moist atmosphere." Black snakes and garter snakes are interesting and harmless.



Salvaging sunken ships with collapsible floats. As the floats swell they displace the water and cause the vessel to rise

Raising Sunken Ships with Collapsible Air Bags

A NOVEL method of salvaging sunken ships has been devised by Dr. Sylvio Pellico Portella, of Rio de Janeiro.

The invention consists of a specially built tender which carries collapsible floats made of waterproof material. The floats occupy very little space until they are put into use and inflated. They are constructed in such a manner that they will assume a number of different shapes when they are inflated.

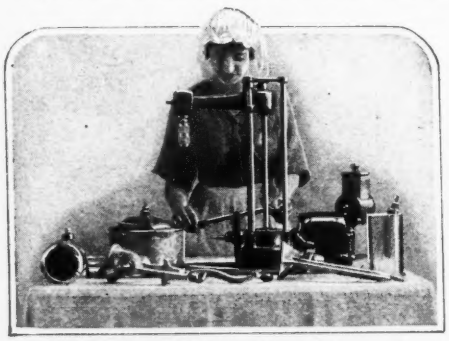
Taken down to the wreck by divers they are attached to the vessel both inside and outside and are connected with the tender by lines of hose. When in place they are inflated by air pressure from the tender. As they swell they displace the water from within as well as from without, and their buoyancy causes the wreck to float upward to the surface.

Solving Kitchen Problems Electrically

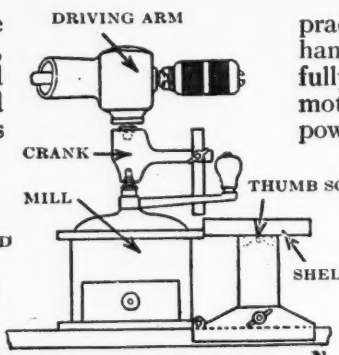
One little electric motor which may be set up anywhere does all the tedious jobs

THE slogan "Do it electrically!" has long since been echoed by the queens of the kitchen in the private homes of the cities as well as in the more modern farmhouses. But of all the electrical inventions to make the work of the kitchen light, perhaps none is useful in so many different ways as the one shown in the accompanying illustrations.

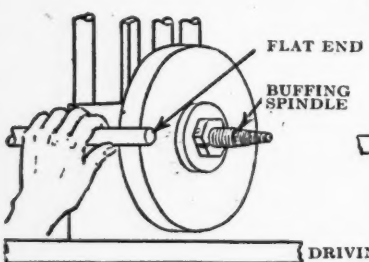
It is primarily a small electric motor and may be used to operate any of the hand-power kitchen utensils such as the coffee grinder, ice cream freezer, egg beater, cake mixer, bread mixer, cream whipper, and food chopper. The device is simple, takes up little table space and consists of an electric motor mounted on a base plate together with two vertical rods carrying an arm which may be slid up and down to adjust it to the kitchen tool being used. This arm carries the driving shaft operated by the electric motor through a universal joint and is provided with both horizontal and vertical end shafts for driving utensils which are turned respectively by horizontal or vertical shafts. This permits practically any utensil turned by a hand-crank or wheel to be successfully operated by the device. The motor is of one-sixteenth horsepower and may be driven off the



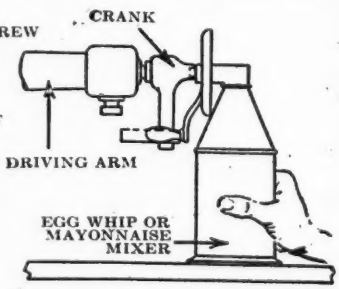
The motor with its adjustable crank-arm takes up little table space



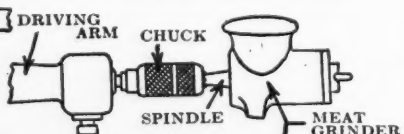
Here the coffee is being ground by the crank arm of the motor

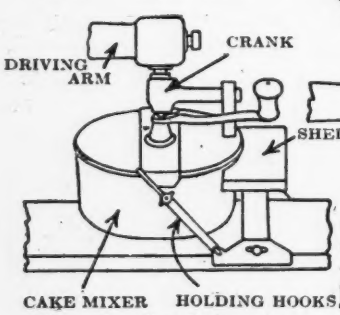


A high speed emery wheel driven off the motor armature shaft

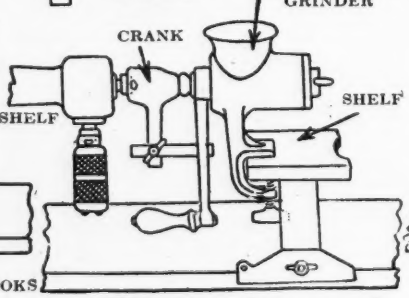


Eggs may be beaten, cream whipped and mayonnaise mixed by the device

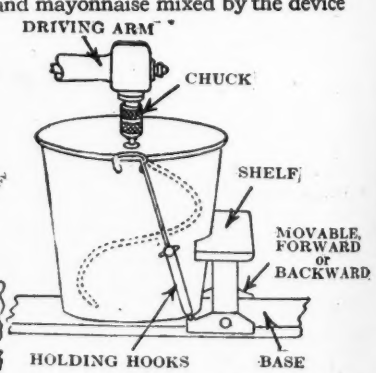




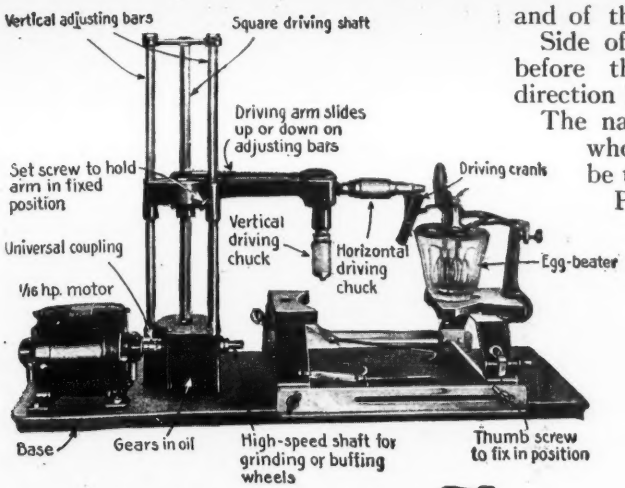
How the electrical motor may be connected up with the ordinary cake mixer



How meat choppers and food grinders of all kinds are operated by the motor



The bread will be uniformly good when mixed by the motor attachment

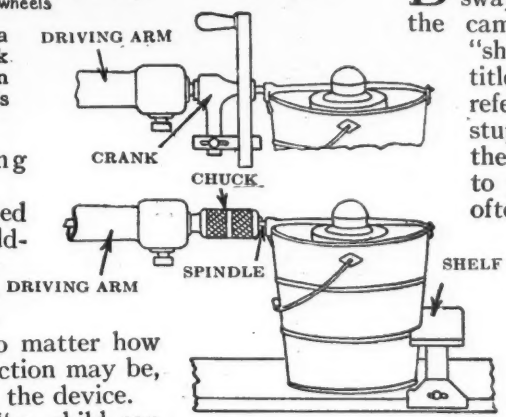


The motor is carried on a base plate. The crank arm slides up or down on the two vertical rods

ordinary lighting circuit.

The base is provided with clamps for holding utensils usually furnished with table-clamps so that practically any utensil, no matter how awkward its construction may be, may be operated by the device.

The old saying "a child can do it" is especially applicable here.



The ice cream freezer may be driven either by the chuck or the crank arm

The Automobile Driver Must Know What to Do in Case of Accident

IN case of accident, a chauffeur or automobile driver should stop and note the following facts:

The speed at which he is traveling.

The exact width of the road and the condition of its surface.

What signs he gave of his approach; for instance, horn, bell, voice, etc.

If after dark, whether his lamps are burning in accordance with regulations.

The number and description of the other vehicle.

Whether the other was on the proper side of the road or not, and what light or lights were showing.

Measurements of wheel tracks from sides of road, both of his car and of the vehicle with which he collided.

Side of road on which he was traveling before the accident happened and the direction he was going.

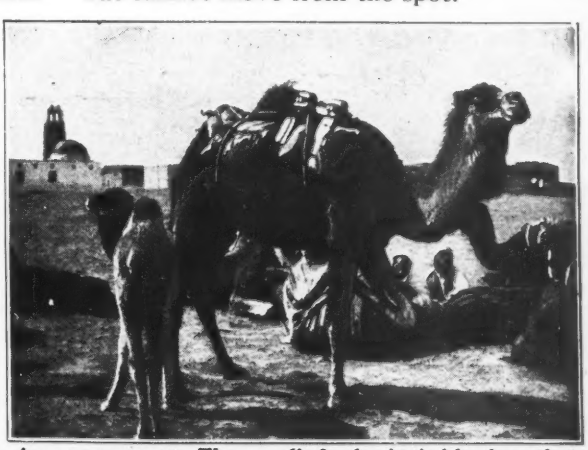
The names and addresses of bystanders who witnessed the accident should be taken.

Particulars of the manner in which the person with whom he collided was driving should also be ascertained.

How the "Ship of the Desert" Is Anchored When the Caravan Rests

BECAUSE of its peculiar swaying motion in walking, the camel has been called the "ship of the desert." This title may also have some reference to the extreme stupidity and passivity of the animal, which submits to great loads, which it will often carry for days at a time without stopping for food or drink, with no more urging than a ship would require from the hands of its pilot.

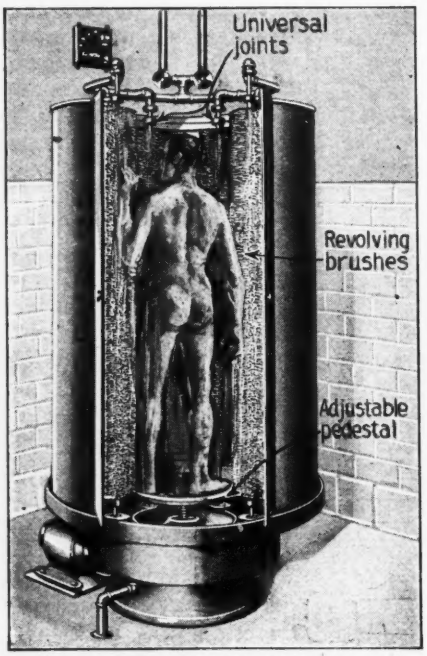
The manner in which the drivers hobble the camels when they stop for a rest is interesting. They do not depend upon stakes driven in the deep, yielding sand, but simply double back and tie one of the forelegs of the animal, so that it can lie down or rise up but cannot move from the spot.



A caravan at rest. The camel's foreleg is tied back so that it can lie down or rise up but cannot move from the spot

It Bathes, Massages, and Dries Us. Would That It Dressed Us, Too

A RECENTLY invented bathing machine not only washes the body, but also gives a massage and dries the skin without the use of a towel in less time than is required by the usual process. The machine takes up so little space and requires so little water that it may be used in a sleeping car or in other places where space or water is limited. For army use it meets every requirement of sanitation and speed when mounted on a truck so as to be moved about as needed.



The bathing machine requires so little space and water that it can be set up even in a sleeping car

The body is thoroughly cleansed by a series of brushes driven at will at either high or low speed. Each brush is eight inches in diameter with three-inch bristles. The brushes are hinged at the top on ball joints so as to open out wide for a fat man or close in for a thin one. The foot or arm can be easily thrust between any two of the brushes and thoroughly washed. An adjustable pedestal at the bottom is easily moved up or down to accommodate a tall or short person. Above are the claims which, if true, are certainly remarkable.

All the moving parts are electrically operated. The insulation and connections are so designed that the bather takes no chance of getting a shock.

A New Siphon That Starts Itself Without Suction or Pumping

AN automatic siphon has been perfected recently which seems to have a fine disregard for the law of physics that a liquid can rise no higher than its source.

The device is exceedingly simple. It is constructed along the usual lines except that the end which is placed in the liquid has three tubes instead of one. The liquid enters through the center tube and rises to the level of the liquid in the jar. At the same time the liquid enters the opening in the outer tubes and traps the air above it. This subjects it to hydrostatic pressure, which increases with the depth. The air in the bulb is forced upward by the pressure of the liquid until it rises over the point where the bulbs join the main tube.

The air raises the liquid standing in the main tube to the bend in the siphon and it immediately starts to flow downward.

As soon as the steady flow begins, the pressure is diminished and more water is drawn through the injector into the main tube. As the water rises higher in the bulb the air which is sandwiched between little columns of water in the delivery tube is expelled. It is only a matter of seconds for all the air to be expelled and the apparatus then performs its work like any other siphon.

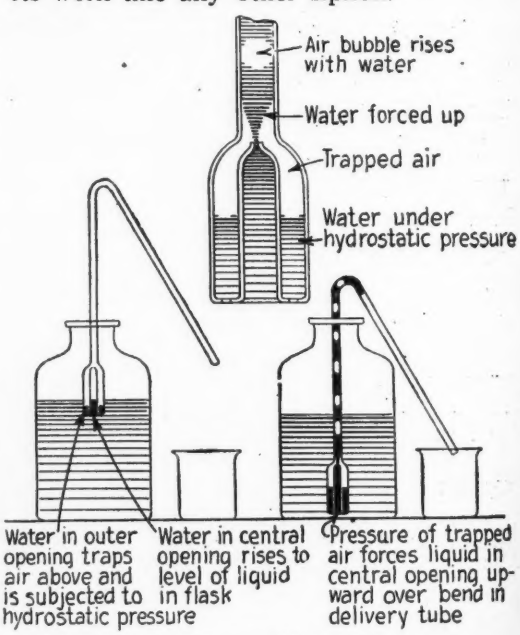
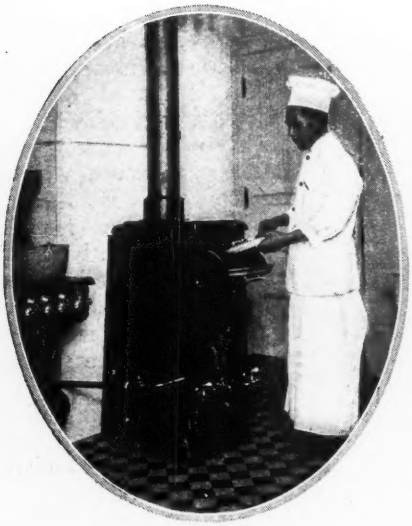

Air bubble rises with water
Water forced up
Trapped air
Water under hydrostatic pressure
Water in outer opening traps air above and is subjected to hydrostatic pressure
Water in central opening rises to level of liquid in flask
Pressure of trapped air forces liquid in central opening upward over bend in delivery tube

Diagram showing the siphon which requires no pumping or suction to start the flow

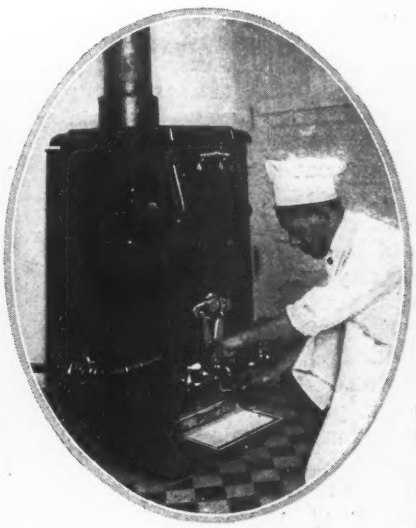
Abolishing the Garbage Can

A gas-burning crematory is the latest sanitary device for disposing of refuse



The refuse is scraped directly into the incinerator. There is a constant draft which carries all odors up the flue

The residue is only a very small quantity of sterile ash. You light the incinerator just exactly as you would your gas oven



PROBABLY a perfect method of collecting garbage fresh and hurrying it away in sanitary vehicles will never be found. Only by burning it on the spot will all danger and trouble from flies, odors and germs be averted.

A device which does this simply, thoroughly and economically, has recently been invented by a New York man. It is in the form of a garbage crematory, which can be conveniently installed in either new or old buildings, residences, apartments, hospitals or hotels, at the place where the waste originates. It destroys by incineration all house, kitchen or sick-room waste, wet or dry, animal or vegetable, before it has a chance to become a menace to health.

The machine generates about 1,200 degrees of heat, but is so constructed that the radiation is reduced to a minimum. It is lined with asbestos with an air space between the outer and inner walls, to provide for constant circulation.

The cost of operation is very slight, five cents worth of gas being sufficient to destroy a bushel of garbage, which requires from three-quarters of an hour to one hour to burn, depending upon its nature. The residue is only a very small quantity of sterile ash, which may be dumped back in the hopper on top of the following day's accumulations, and burned over and over until you are ready to dump the ashes.

In large apartment houses the incinerator means a considerable saving in janitor service, to say nothing of the annoyance of having garbage cans to handle.

The heat in a kitchen from such a machine is not any greater than that from the range, but the proper time to operate the incinerator is after all other work in the kitchen is finished, so that in the summer there need be no annoyance from its heat.

If the incinerator is installed in the kitchen or nearby where it can be connected with the flue from the kitchen range, all garbage cans and similar receptacles for refuse may be eliminated. The waste can be dumped immediately into the machine and allowed to collect there until there is opportunity to burn it. If one day's accumulation does not fill the machine, it may be left standing until three or four days' waste has collected. No odor escapes from the machine, even after the garbage has been left in it for several days, because a constant draft entering from beneath carries any odors up the flue. The operation of the incinerator is so simple, however, that it will be found just as easy to burn up the garbage of one day as it will to wait several days for an accumulation of waste. You simply apply the match to the lighter, exactly as if you were lighting your gas oven.

Joseph's Coat of Many Colors Was Not More Gorgeous Than This

THOSE who are in a position to know, tell us that three dollars is a fair average price for an elk tooth, such as are sold to jewelers and to members of the Order of Elks. Much higher prices are paid for very good specimens. A curio dealer in Steubenville, Ohio, has a coat covered with 3300 of these teeth, which he values at $10,000, and does not wish to sell it at that or any other price. The coat proper was made by an Indian in Manitoba, Canada, and is sinew-sewed. It weighs twenty-eight pounds. There are two rows of antelope teeth, one hundred and fifty-nine in all, down the front. The owner of the coat is a prominent member of the Order of Elks and wears the coat at all conventions. With the coat the owner wears an ornate necklace made of the largest of the elk teeth in his collection.

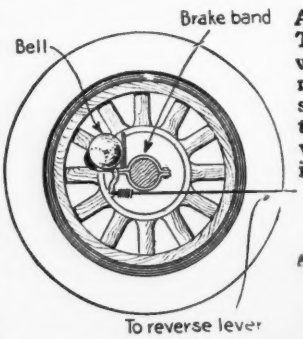
The coat, covered with elk teeth, weighs twenty-eight pounds. There are two rows of antelopes' teeth down the front edges

Bell Gives Warning When Automobile Backs Up

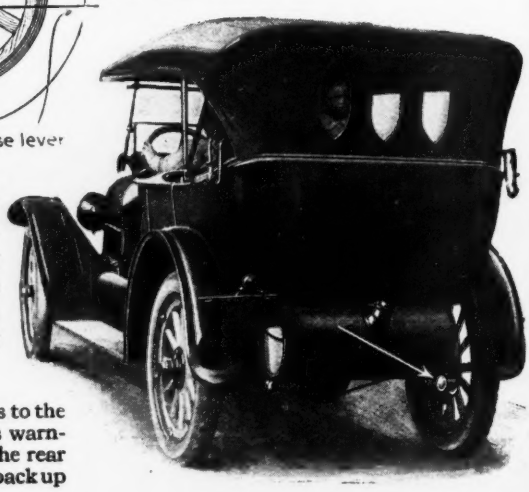
THE simple clock-like device shown in the accompanying illustrations, the invention of Ernest P. Hoover, of Wilton Junction, Iowa, is designed to ring a warning bell automatically as soon as the reverse gear of an automobile is thrown into mesh, and thereby prevent collisions with following cars. The device consists of a cylindrical casing pivoted on a bracket attached to the rear axle and carrying a shaft with a disk which may be thrown into contact with one of the rear wheel brake drums when the entire casing is swung about its pivot by the act of throwing the car's reverse gear into mesh. The pivoting action of the casing is effected by means of a bell-crank lever on the casing and a wire or rod leading from the bell-crank to the gear-shifting lever or pedal.

The sounding bell is mounted on one end of the casing. It is rung by means of a pivoted hammer oscillated by means of a small star cog-wheel mounted on the same shaft as the disk which is made to contact with the rear brake drum as the reverse gear is thrown into mesh. A ratchet wheel on the other end of the disk shaft is made to rotate by a small dog on the disk which is loosely mounted on the shaft. This loose mounting of the disk and the direction or shape of the ratchet teeth permits the bell to remain inoperative should the disk in any way be thrown into contact with the brake drum while the reverse gear is not in mesh.

The bell begins to ring as soon as the automobile begins to back up, and the warning is sounded continuously until the car comes to a standstill, thus avoiding all rear-end collision. It would be almost an impossibility for anyone but a deaf person to disregard it.



At left: The bell which rings as soon as the reverse gear is in mesh



The arrow points to the bell which gives warning to those in the rear that the car will back up

Breaking the Chain That Binds Us to Earth

We might escape if we could be shot into space at a speed of seven miles a second

By Charles Nevers Holmes

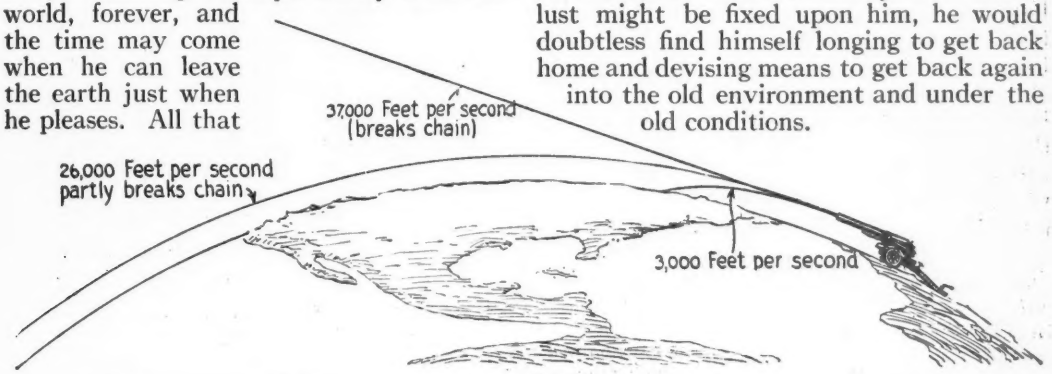
MAN is chained to his Earth, his planet-home. His chain is invisible, but the ball is always to be seen—the Earth itself. The chain itself is apparently without weight, while the chain's ball weighs about 7,000,000,000,000,000,000,000 tons!

This ball or Earth acts like a huge magnet, drawing us towards it, and the force of this terrestrial attraction is popularly expressed in what we call our "weight." Everyone of us is, therefore, chained to the Earth by his "weight." Although the invisible chain permits us to roam almost anywhere upon the surface of our planet-home, it ties us to this terrestrial home, and we can no more leave our Earth than we can fly through its atmosphere without artificial wings.

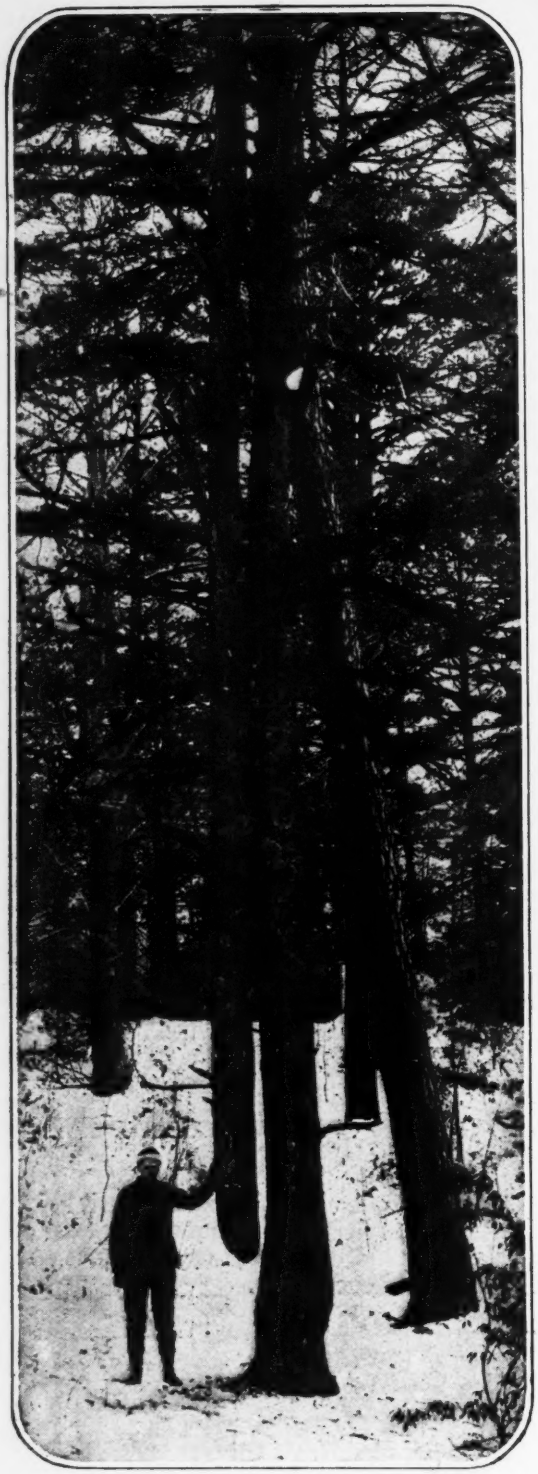
It is true that man, assisted by the lifting power of certain gases or machinery, may rise in a balloon or airplane thousands of feet above his Earth's surface, and reach a level where he can not breathe with comfort. His terrestrial chain can be stretched somewhat, so to speak, but there is a limit to this stretching. The chain is still there, although he may not feel it, and for a short while may forget its existence. Despite twentieth century science and invention, man has not yet broken his terrestrial fetters. He may escape several miles above the floor of his planet-home, but sooner or later he has to return to that floor, sometimes more speedily than is safe for him.

Yet man might escape wholly from his world, forever, and the time may come when he can leave the earth just when he pleases. All that is necessary is velocity—velocity greater than that of modern war-projectiles, swift as they seem to be. Such war-projectiles possess a muzzle-velocity of from two to three thousand feet per second, and after a comparatively short flight the invisible chain pulls them down to the ground. But were these projectiles to travel at a far higher speed, say about 26,000 feet per second, they would never fall to the earth's surface, unless interfered with, but would travel forever around and around our world. That is, the terrestrial attraction would be just balanced by the velocity of the projectiles.

If this speed were further increased, if a projectile were given a velocity of 37,000 feet, or approximately seven miles a second, it would then leave the earth and never in all probability be seen again. And if a man were enclosed in this projectile he would, of course, escape from his planet-home. So that any one of us may depart our world if only an air-ship is invented that can be shot from the terrestrial surface with an initial velocity of 37,000 feet per second. Any one embarking on such an air-ship would very quickly break the chain attaching him to this earth. But although he would be able to leave this world, in all probability he would not be able to return. And a permanent exile from this planet, roving around in space, might receive a very cold reception at the surface of the Moon or a very hot one at the surface of the Sun. However firmly the wander-lust might be fixed upon him, he would doubtless find himself longing to get back home and devising means to get back again into the old environment and under the old conditions.



All that is necessary to enable man to escape from his planet home is velocity—velocity greater than that of war projectiles and great enough to balance the terrestrial attraction



The portion of the grafted branch below the lowest graft union is still living and laying on wood rings annually. The graft has outdistanced the mother tree and most of the other trees of the locality in its growth

The Cut Branch Did Not Die. It Grafted Itself and Lives

IN the accompanying illustration is shown an unusual graft of two branches of a white pine tree, now completely severed from each other at the original point of union, but both still in a thriving condition because of a number of graft-unions along the twin trunks.

The tree stands near Mont Alto, Pennsylvania, where a large charcoal iron furnace was formerly operated. In 1882 a laborer at the furnace was injured, and in accordance with the then prevalent belief, a companion laborer immediately set out to procure a supply of fresh white pine tree pitch with which to treat the wound. He selected the tree under discussion and cut therefrom a number of large chips at a point about three feet from the ground where the tree divided into two branches. The branch on the cut side of the tree was not completely severed at the time of the cutting, but in a few years the uncut portion rotted out and thus severed the one fork entirely from its original connection. To the astonishment of all who watched the development of this unusual tree, the severed branch continued to live. Everyone, however, predicted that this apparent condition of thrift could continue only for a short time. On the contrary, the top of the severed (dependent) branch, thirty-five years after the original cutting, is now growing more rapidly in height than the rooted branch. The following figures show the annual height growth of both branches during the past decade:

	Height Growth in Inches	
Year	Severed Branch	Rooted Branch
1916	10	5
1915	14	10
1914	10	9
1913	4	11
1912	16	7
1911	8	10
1910	6	6
1909	14	9
1908	19	12
1907	30	12
Total	131	91

The portion below the lowest graft union, which begins eight feet above the free end and extends along it for five feet four inches, is still living and laying on a ring of wood each year down to the point where the man's hand rests.

Photo by Bureau of Education, Washington

Ready to start a reindeer race at Igloo, Alaska. Two hundred Eskimos, all of them engaged in the reindeer industry, fourteen wild deer and numerous collie dogs took part in the sport

How the Eskimos of Alaska Held an Exciting Reindeer Fair

THE first reindeer fair held in Alaska took place recently at Igloo. It was attended by about two hundred Eskimos, all engaged in the reindeer industry on Seward Peninsula. The fair was a great success; for it gave the Eskimos a chance to exchange views on such problems as the best way to raise and drive reindeer and the best types of sleds and harness.

A herd of eight hundred deer was exhibited. They were not confined in a corral, but were kept in place by the crowd of eager sightseers, ever alert to prevent an excape. Intelligent, trained collie dogs hovered around the outskirts of the crowd to round up a deer that might break through.

Interesting features of the fair were the lassoing contests and the races. Thirty minutes each day for three days were devoted to lassoing. Only bulls without horns were lassoed. The winner of the contest had eleven deer to his credit. The bulls are difficult to lasso because of their wariness.

The driving race was held over a course a mile long. There were fourteen wild deer in it.

Photo by Museum of American Indian

A "swallow stick"—a 400-year-old relic from the Virgin Islands

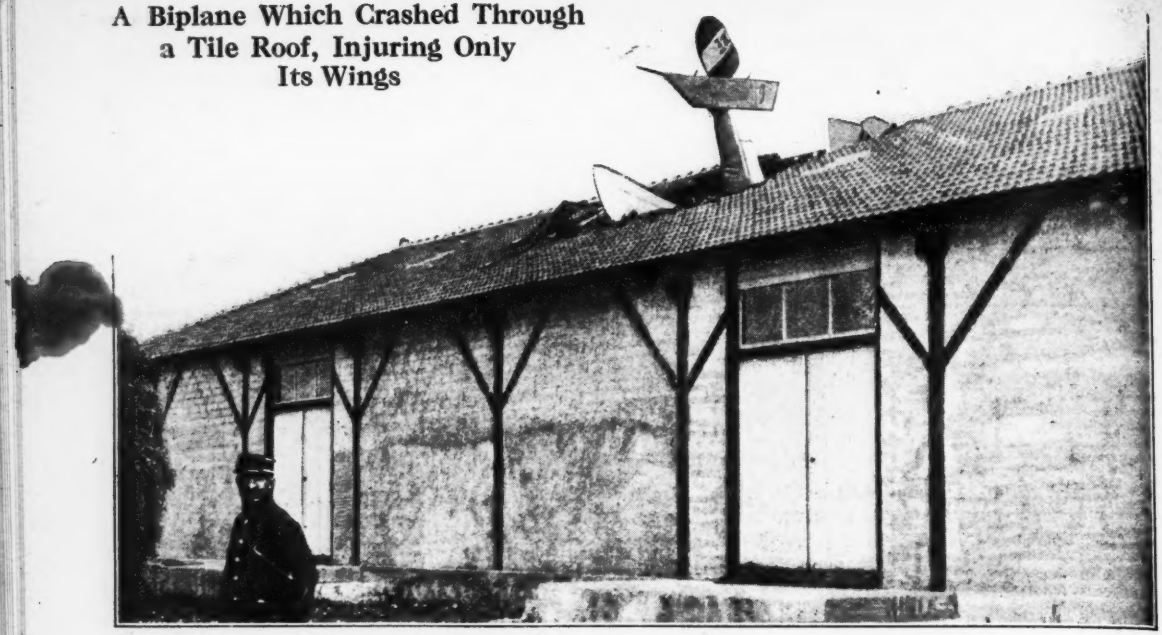
The Old Indian Priests Had No Easy Time of It

THE Indians are faith curists. But in South America certain tribes, more highly developed than others, had priests instead of medicine men in their religious ceremonies. These tribes were very particular about their priests. They argued that in order to be a successful intermediary the priest must be thoroughly cleansed of all impurities himself.

To make perfectly sure that the priest was worthy, a "swallow stick," such as the one shown in the illustration, was thrust down his throat. This, of course, acted as an emetic, and satisfied the audience that the priest was purged of his iniquities and could proceed with the ceremony.

The "swallow stick" in the photograph is one of four specimens brought from the Virgin Islands to the United States by Captain Theodore De Booy, explorer for the Museum of the American Indian, of New York City. It is estimated to be over four hundred years old, and is made of the rib of a sea cow. Three inlays of mother-of-pearl form the teeth. The eyes are shells set into hollows.

A Biplane Which Crashed Through a Tile Roof, Injuring Only Its Wings



© Int. Film Serv.

It was a lucky chance that the machine struck a comparatively fragile roof, in tearing through which it could expend its energy. The broad wings cut through a corresponding expanse of roofing

ONE of the pioneers of modern flight was Otto Lilienthal. He used to run down a hill with a glider (two outstretched wings connected by a handle-bar which he grasped), lift up his legs when he had gained sufficient momentum, and float down for several hundred feet. To maintain his balance, he would throw his weight around. Sometimes he was not quick enough and he would come crashing down to the ground. He used to say that his crude, motorless monoplane was not dangerous because if he could only manage to slide down edgewise, the wing would act as a buffer. To be sure, the wing's ribs would be broken; but then his own would be saved. He wrote of one instance in particular when he lost control because he was too tired to throw his weight to the front. A tail-slide and a dive resulted. His life was saved by an elastic-curved bar of willow wood which he had added in front of the wings.

The American apprentice who flew the machine, the tail of which is seen in the photograph above, will probably endorse Lilienthal's observations. At an altitude of five hundred feet the American lost control and plowed through the roof of a barrack building as if his machine were a battering-ram. That he escaped without a scratch once more illustrates the old mechanical truth that when two bodies collide the weaker collapses and acts as a buffer for the stronger. The accident also demonstrates the protection afforded by a modern tractor biplane, provided, as it is, with a deep cock-pit in a very substantial body and constructed so that the weight of the machinery is all in front of the aviator.

Bringing the toes into their proper position by means of a toe spring

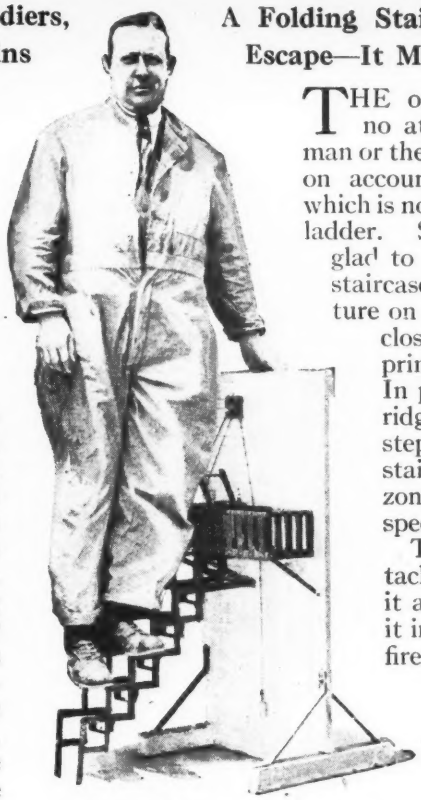
A Toe Spring for Enlarged Joints and Bunions

ONE effective method of dealing with. crooked toes, enlarged joints and bunions is to bring the toes into the proper position with a toe spring. This removes the cause of the enlarged joints and bunions, which will naturally disappear as a result. The toe spring is worn at night, and if necessary may be worn also during the day with a special shoe; it is attached to the foot in such a manner as to cause no discomfort or inconvenience. In cases of severe soreness or inflammation, an ointment applied to the sore part prevents irritation from the spring.

Reaching the Wounded Soldiers, Far Up in the Mountains

THE recent invention of a Massachusetts militiaman, Paul P. Alex, will be appreciated by the fighters in the mountain regions. It is an apparatus for carrying a wounded man comfortably on the back of an animal, and consists of two frameworks mounted upon the sides of a special saddle. One framework is stationary. The other, however, can be unclamped and be set upon the ground when a soldier needing attention is found. In opening out this framework, a toggle link is extended above the horse. With this link as a supporting member, the wounded soldier can be hoisted up on to his stretcher. Close up the framework once more, clamp it back in place upon the saddle, and the wounded man can be transported in comparative comfort.

On the journey over the trail to the dressing station, the soldier will be carried flat just as he would be were he in the ordinary ambulance. Even the most severely wounded can be moved with no more inconvenience than would be felt in an ambulance.

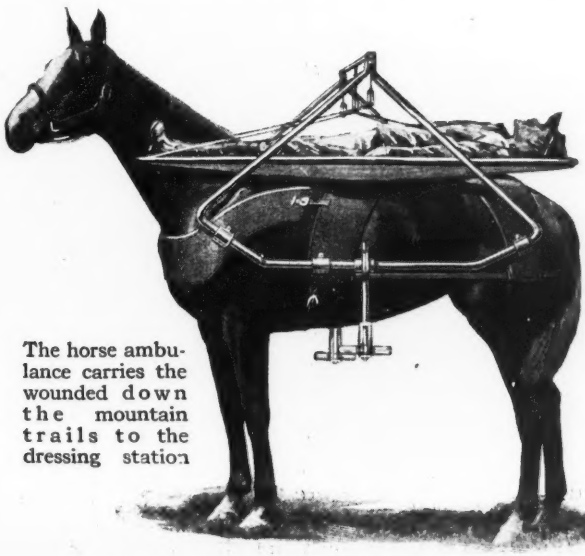


A tiny model of the folding staircase supporting a champion heavyweight to show its strength

A Folding Staircase for the Fire-Escape—It Makes Descent Easy

THE ordinary fire-escape has no attraction for the timid man or the fat woman, principally on account of the lower part, which is nothing more than an iron ladder. Such persons will be glad to hear about the folding staircase illustrated in miniature on the left. It opens and closes on much the same principle as an accordion. In place of the accordion's ridges, however, are the steps and backs of the staircase which are horizontal and vertical respectively.

The counterweight and tackle of the staircase make it an easy matter to bring it into position in case of a fire. First a push, then a few pounds pull on the counterweight ropes, and the staircase drops from the balcony under its own weight. What was formerly a huddled mass of flat steel bars becomes a real staircase, by means of which it is easy to escape. When not in use the staircase is kept folded up on the first balcony out of sight and out of the reach of burglars.



The horse ambulance carries the wounded down the mountain trails to the dressing station

Administering the Chloroform to Some Old Sayings

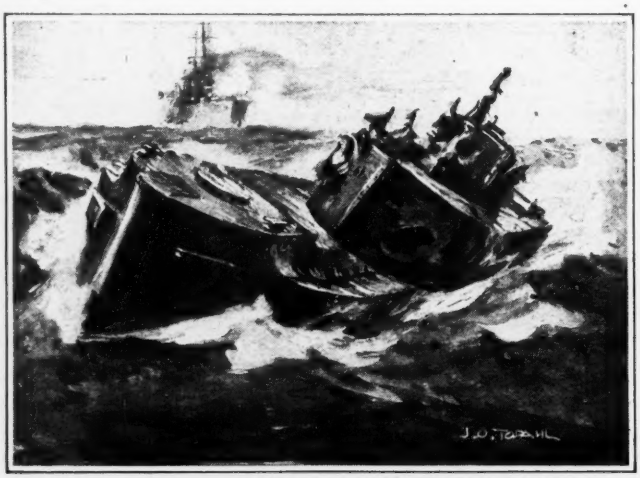
THE Arctic explorer Stefánsson—who ought to know—has knocked the foundation out from under several old sayings which had come to be regarded as solid facts. Among other things he says authoritatively that frost-bites cannot be remedied by rubbing snow on them; that there is no harm in eating snow when you are thirsty; that Eskimo houses are well ventilated and are not generally ill-smelling; and that in his whole experience north of the Arctic Circle he has never encountered anything so bad, so sudden or so disconcerting as a typical North Dakota blizzard.

The Unsinkable Submarine

When struck, it simply discards the injured section and proceeds on its way

THE submarine may strike you as a very deadly thing. But the most formidable U-boat in the German Navy is as nothing compared with the submarine as Alphonse Fernandez of Spain would have it. Mr. Fernandez has patented some improvements on the submarine which render these terrors of the sea far more deadly than they are at present.

His invention provides the submarine with a detachable upper section. This section contains all the armament except the torpedo tubes. When a submarine is attacked and injured it capsizes because of the weight of the water which enters the injured part. If the Fernandez submarine is attacked by gun fire, is hit by a bomb dropped by an aviator or strikes a mine, the injured section may be cast off. The crew enters the remaining section and the enemy is deprived of victory.



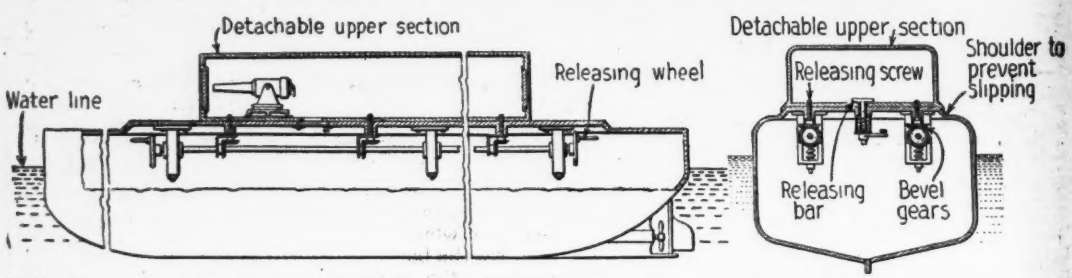
If the upper part of the submarine is struck, it may be detached and discarded without affecting the boat's safety

The two sections are fastened together by screws which have bevel gears on their lower ends. In the main body there will be a longitudinal shaft having bevel gears which mesh with the gears on the ends of the screws and will release all of the screws when the shaft is turned. This construction makes it only the work of a moment to separate the main body of the vessel from the upper section.

Another invention of Mr. Fernandez provides a deep-sea boat which carries a small vessel just as a kangaroo carries its young in its pouch.

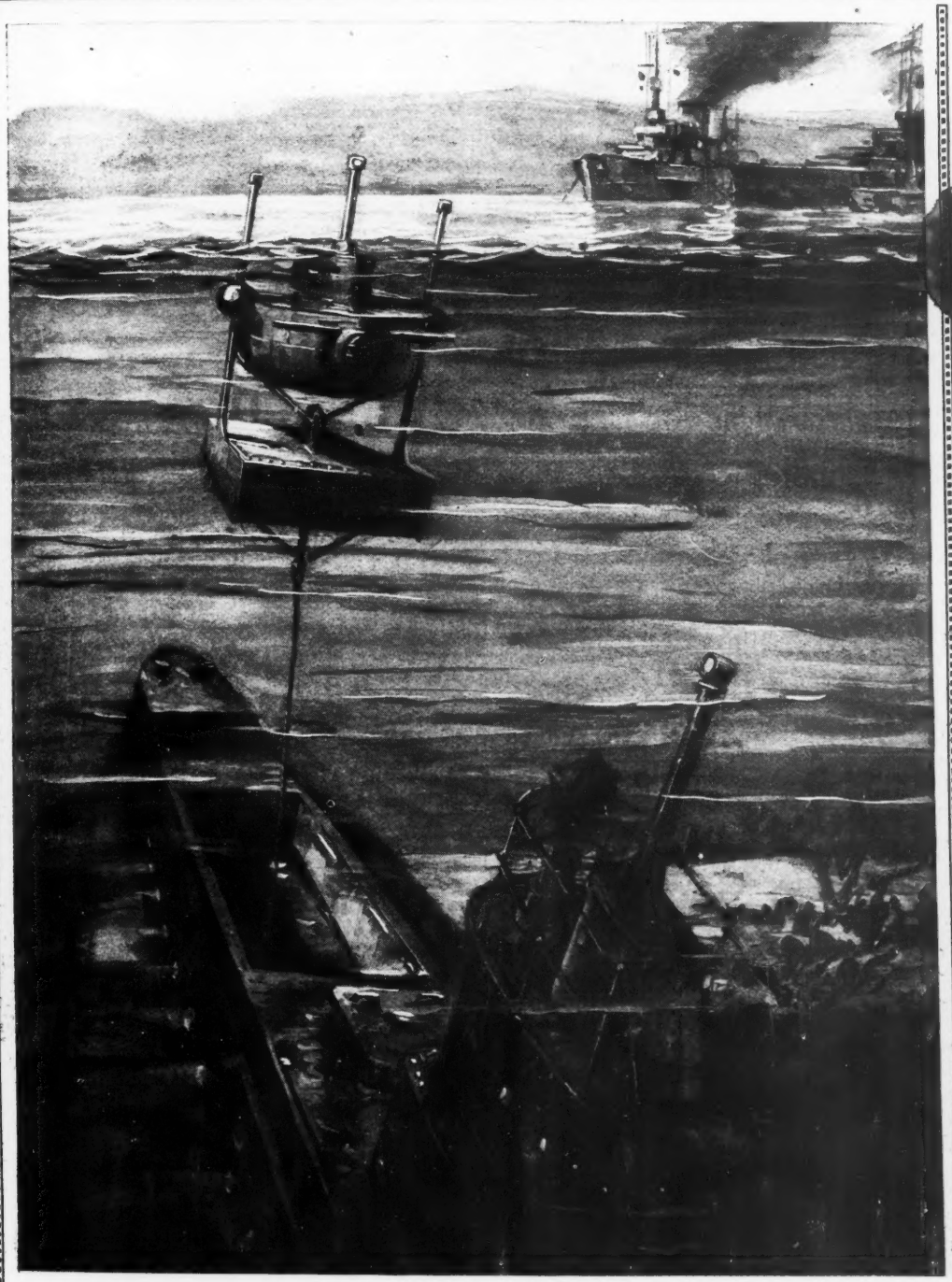
Suppose, for example, that the large submarine reaches the mouth of a river up which it cannot pass because the water is too shallow. The enemy has a number of ships resting at anchor on that river. The mother ship submerges and opens the doors of the compartment in which the small vessel is carried. This is done very easily as the miniature submarine has a hatchway by means of which it may be entered from the compartment. The torpedoes which it requires on its journey of destruction are loaded on it from the mother ship. When the crew which is to man it enter and all is in readiness the small vessel is set free by opening the doors of the compartment and releasing the miniature ship from its coupling.

Its mission accomplished, the baby returns to the mother submarine.

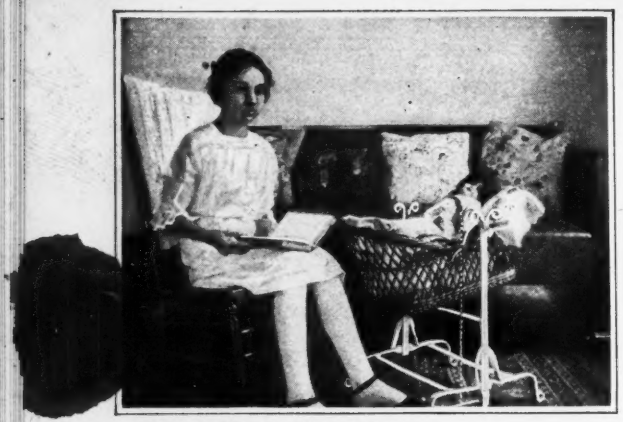


The two sections of the submarine will be fastened together by screws which have bevel gears on their lower ends meshing with a longitudinal shaft in the body of the vessel which releases them

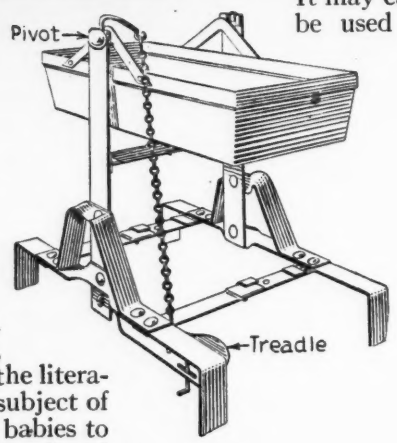
The Mother-Submarine and Its Baby



The miniature vessel is carried in a kind of pocket in the large submarine in much the same way that a baby kangaroo is carried in its mother's pouch. When the mother submarine encounters a piece of work in shallow water, or which is for any reason difficult for it to accomplish on account of its size, it releases the baby vessel, which is armed and manned for the task. Its work accomplished, the baby returns to its mother



The cradle complete. The framework is hinged together so that it is easily collapsed and stored away



Pressure on the treadle bar causes the cradle to tilt forward. The weight of the child brings it back

Rocking the Baby Fore and Aft

WHEN William F. Walsh, of St. Paul, Minn., finished reading all the literature he could find on the subject of the harmfulness of rocking babies to sleep in cradles, he was convinced of only one thing—that the harm lay in the direction of the motion, not in the rocking itself.

Therefore he gave his attention to constructing a cradle for William, Jr., which would have a gentle motion forward and back to equilibrium, rather than from side to side. The result of his effort is shown in the illustrations above. One of these shows a detail drawing and the other the perfected cradle in miniature. Being a plumber by trade, Mr. Walsh used gas pipe for the frame of the first model, but later resorted to band iron in order to make the cradle collapsible.

The basket of the completed cradle shown in the illustration is suspended between two side standards braced by the base framework. A chain extending from an arm of the pivot pin at one side of the basket is connected with a treadle. In operation, a light pressure on the treadle bar will cause the basket to tilt forward slightly. When the foot is raised from the treadle the weight of the child in the basket restores the cradle to equilibrium.

A gentle motion is secured which is neither a swing nor a roll and which the inventor believes will not affect the nerves of the most susceptible infant. The parts of the framework are hinged together so that they may be easily disconnected to be stored away when the cradle is no longer needed. There is room for indulgence of personal taste in the choice of the material and design of the bed portion of the device. It may easily be a basket which may be used for other purposes later. Or the shape shown in the detail of the design may be used, made up in metal or wood. Rods may be attached to the framework for curtain supports.

The Pull-Motor: It Takes All the Work Out of Skating

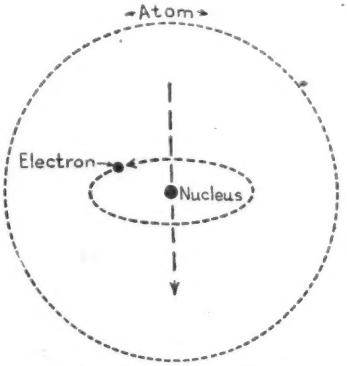
HAVING motorized about every other sport, the engineers have turned to skating, and by making a motor-wheel pull instead of push, they have taken all the physical effort out of the sport. With the motor-wheel all you need do is to steer with the handlebar and hold on, paying your respects to your friends as you scoot by them.

To make the wheel useful for ice work, strips of steel are fitted to the wheel to form a handle. A wooden crossbar, about fifteen inches long, fitted across the top, serves as the steering apparatus. The control wires are attached to the wooden handle. Murray Fahnestock, of Pittsburgh, Pa., is the man who conceived the idea of putting the wheel to work on the ice. According to Mr. Fahnestock, the sight of a big collie dog pulling a girl over the ice gave him his inspiration for the motor-wheel.

Steel strips and a handlebar on an ordinary motor-wheel make a pull-motor to whizz you over the ice

Magnetizing Steel Without Using a Lodestone

DR. S. J. BARNETT, of Ohio State University, has recently discovered an entirely new method of producing magnetism—the first since the finding of the lodestone or natural magnet in ancient times, by means of which a magnetic field was produced in which the body to be magnetized was placed. Dr. Barnett, however, has been able to produce magnetism without the influence of any outside agency, by simply rotating a piece of steel at a speed of about forty-five revolutions per second. Perhaps this fact may help in the final solution of the great problem of the earth's magnetism which has puzzled scientists for ages.



In the electrical theory of matter, each atom is a negatively charged particle revolving about a positive center

If a bar of steel can be magnetized by rotating it, why can't the earth produce its magnetism in the same way, as it rotates upon its axis?

In the first place he has found that a bar of steel behaves just as if its molecules were little spinning tops, or rather minute gyroscopes. These gyroscopic molecules line up with their axes parallel to the axis of rotation of the bar, and because each molecule acts as a magnet the whole bar then becomes magnetized.

The reason why the molecules act as they do has been very carefully worked out and the result seems to substantiate the now common electrical theory of matter. This theory assumes that each atom of matter consists of a positive center about which a little negatively charged particle is rotating at very high speed. From this it is deduced that each atom *is* a minute gyroscope and that the negative particle rotating about its axis acts just exactly like an electric current and magnetizes the atom.

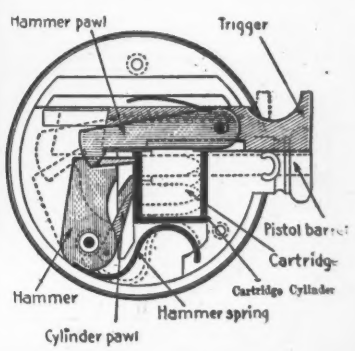
"Hand Over Your Watch!" Why Certainly, Mr. Burglar

WITH a revolver disguised as a harmless watch, Leonard Woods, of St. Louis, Missouri, hopes to get the "drop" on a burglar who has the drop on him. When he has been asked to hand over his watch he will willingly pretend to do so, but he will deliver a volley of hot lead instead.

The device is really a seven-shooter with a repeating mechanism small enough to fit in the limited space of an ordinary watch-case. The encompassing of all the mechanism in such a space is a real achievement. It took Woods several years to do it. The manner in which he finally accomplished it is shown by the accompanying illustration.

The barrel of the revolver is the watch stem hollowed out. The trigger, which slides along on this stem, is placed in such a position that your forefinger naturally encircles it when you are compelled to take the watch from your pocket. As you pretend to be looking at the time, you are actually aiming at the hard heart in front of you. If the thief insists upon having the use of your watch, you can give it to him by simply pressing the trigger. When that is pressed in, the cartridge cylinder will be turned around and the hammer will be brought back until a cartridge is in line with the barrel and the hammer is automatically released.

The barrel of the seven-shooter watch-revolver is the hollowed out watch stem. The trigger slides along this stem



Shooting Shells of a Hundred Tons

It will destroy half a city at one shot and an entire city with three shells

By Charles Beecher Bunnell

THE English are said to be using 21-inch guns which fire 4,000-pound projectiles capable of burying themselves in the ground a depth of thirty-five feet at a distance of ten miles. But they are mere pop-guns compared with the gun that I have designed. My gun will fire a shot one hundred miles. One of these weapons placed at Portland, Maine, would protect her entire coast from Mt. Desert to the Massachusetts line. Another such gun at Newport, Rhode Island, would protect the entire Massachusetts, Rhode Island and Connecticut coasts as far as Bridgeport. A third gun at Lakewood, New Jersey, would reach from Bridgeport, Connecticut, to Cape May, covering as well the entire State of New Jersey.

Elevation of the big gun is controlled by a left-hand wheel operating three dials —a degree dial, a second dial and a minute dial—while point of compass is controlled by a right-hand wheel with three other dials geared similarly

And if we go farther and plant these big guns as thick as lighthouses, all the vulnerable points on the Atlantic seaboard would be placed under instant gun fire. That's quicker than sending out ships or troops, although this gun will not do away with either. For instance, thirty seconds after Boston was attacked, the guns at Newport would be shelling the enemy's fleet, who could not locate the attack or reply to it. From Lakewood, New Jersey, the harbor of New York would be under absolute control; so would Philadelphia, Cape May, and the Delaware River. The whole State of New Jersey would be in its protective range. The moral effect of such a powerful and deadly weapon should not be underestimated. The artillery of few, if any, ships can match it, for two reasons: the cost of a ship to carry such a gun would be impoverishing, and there is no way of locating satisfactorily an unseen object one hundred miles away.

The explosion of the shell sixty feet from an ordinary ship would swamp it and thereby prevent firing of the ship's guns. The concussion alone would destroy the crew and leave the men dead without mutilation.

I have shown the accompanying picture to ordinance officers. "Anyone who laughs at that design is foolish, in view of what's happening every day," said one man who is on Major General Wood's staff. Other Staff Officers said: "I'm very much interested in that gun."—"That gun will shoot a hundred miles."—"Do you realize what that range means to us?"—"That's what we want, big guns and lots of them."—"Go ahead and God bless you."

The rifle is 375 feet long and weighs 39,277 tons without mountings. It has a bore of 60 inches. It throws a shell 26.5 feet long weighing 100 tons a distance of 70 miles at 20 degrees elevation or 100 miles at 45 degrees.

The weight of the shell fired by this gun is always uniform no matter what form of explosive is employed. Its nose is ellipsoidal for the reason that a round shot goes to the left and down, while the conical shot goes to the right and up of any gun's axis. The nose of my shell is the mean between these two extremes.

Ten tons of powder in 20-inch prisms propel the shot, which encounters an atmospheric resistance at the muzzle of 10.45 tons which fades off to zero at the first point of impact. Ignition is reversed; the powder commences to burn at the shell's base and works back to the breech-plug so that the air is not filled with burning powder grains, as is usually the case. Fired point-blank the shell travels twenty-one miles parallel with the earth's curvature, which would permit the shot to perforate two German fleets side by side. At a 70-mile range the gun's possible destructive area is 15,386 square miles; at the 100-mile range, 31,400 square miles.

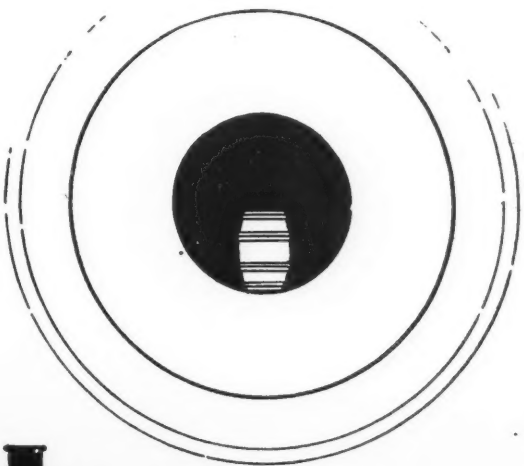
If this gun were using its 70-mile range and it were located at Somerville, New Jersey, it would command New York City, Philadelphia, West Point, Mauch Chunk, Wilmington, Delaware and all the intervening country. One gun on the Panama Canal would command both entrances with deadly accuracy.

The power required to operate the gun is furnished by its own recoil. The rifle automatically assumes the position for firing. The first part of the recoil is absorbed by compressed air cylinders connected with a series of glycerine cylinders. At the end of the recoil the gun is locked in a horizontal position through compensating gear and is ready for automatic cleaning and loading, after which it automatically elevates itself and fires.

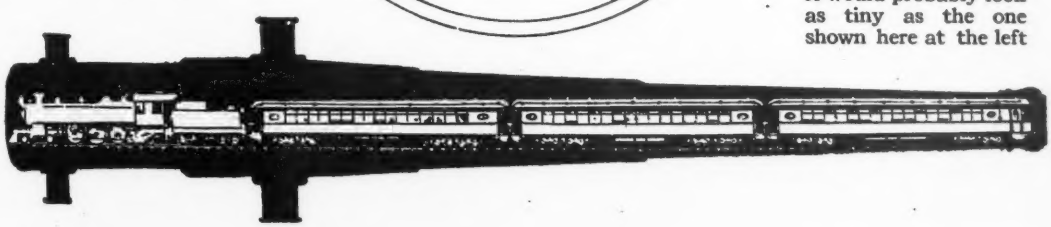
The gun is started and stopped by a foot press. The elevation is recorded by a left-hand wheel operating three dials—a degree dial, a second dial and a minute dial, while the point of compass is controlled by a right-hand wheel with three other dials geared for degrees, minutes and seconds. Since harbors can be ruled off into imaginary numbered squares, it is merely necessary to telegraph the office in charge of the gun that the hostile fleet is in square 22 or 64. The operator places a pantographic pointer on a metallic map at the position designated and the gun does the rest. The area of each square is coincident with the shell's own destructive area, while the whole metallic map is coincident with the gun's destructive area.

The carriage weighs 98,492.5 tons without the gun. It is practically an automobile car resting on 250 soft iron wheels, each of which is 2 feet wide and 2 feet in diameter with 12 grooves in the rims for the rope tires.

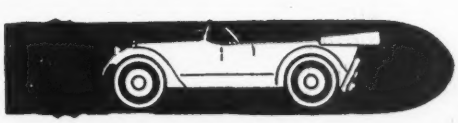
Each wheel's bearings are a fork, like an inverted "U," the handle being a plunger terminating in a compressed-air cylinder. All cylinders are connected and subject to the same pneumatic balance. Each wheel may be turned in any direction by a gear which connects all wheels. Power is transmitted to a certain number through double cranks in a double



If the largest cask you ever saw were placed in the mouth of the gun it would probably look as tiny as the one shown here at the left



In the drawing above you get a fair idea of the length of the bore of the new gun. It could accommodate an engine and a train of three usual-size cars



An idea of the size of the shell used is given at left. An ordinary eight-cylinder automobile could be carried in it and there would be plenty of room to spare

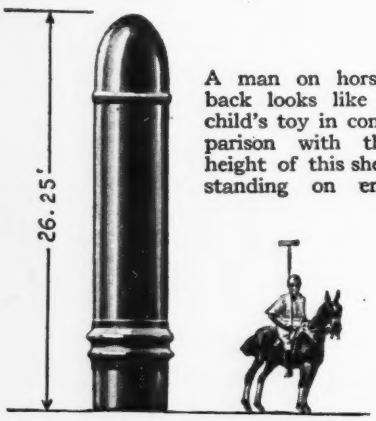
twisted joint sleeve without regard to the position of the upper cranks or the lower wheels.

At rest a series of screws with flat heads descend and level the platform automatically.

The inner tube of any big gun is no stronger than any flaw which it may contain. To make a tube in one piece is like putting all your eggs in one basket. The inner tube of my rifle is designed to take care of the stress developed parallel with the major axis only. It consists of 16 strips of steel, each 375 feet long, 2 feet thick, 22½ degrees wide, each locked with the next, making a tube 375 feet long, 9 feet in diameter, with a 5-foot bore. To take care of the stress at right angles with the gun's major axis, I shrink upon this segmented tube 750 steel rings each 6 inches thick, 12 feet in diameter with a 9-foot hole. These rings are of compressed steel made when in a semi-fluid state and subjected to the greatest pressure that can be developed. Upon these rings a series of steel sleeves are locked and shrunk. Lastly, the trunnion and breech band are placed in position. As a result of this construction the gun is proportionately 40% stronger parallel with its major axis and at right angles to it than a 16-inch gun of the same size would be.

One shell from this gigantic weapon would annihilate Essen and make the Krupp works look like so many heaps of emery powder. Another would make the whole district a Valley of Death for thirty days after it fell.

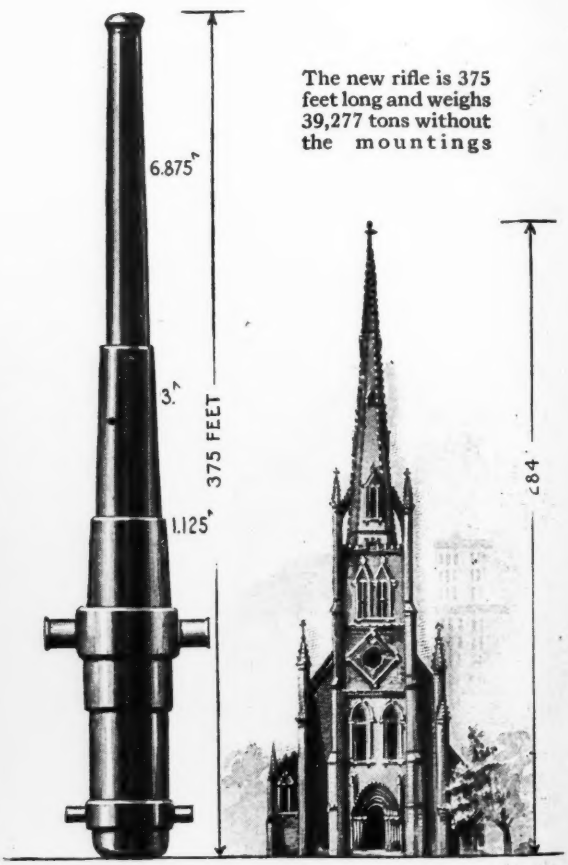
One form of shell used is exploded by



A man on horseback looks like a child's toy in comparison with the height of this shell standing on end

THE SHELL

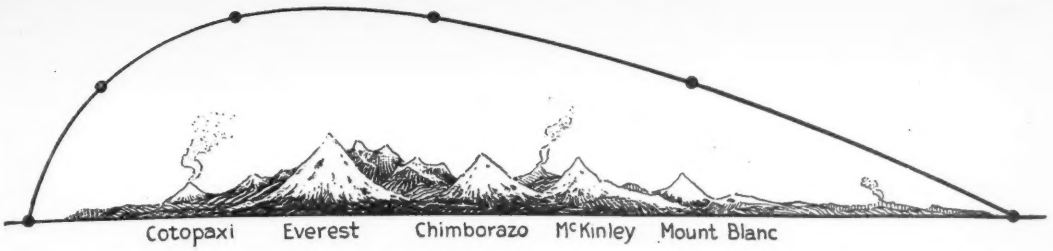
The rifle has a bore of sixty inches, throwing its huge projectile 100 miles



The new rifle is 375 feet long and weighs 39,277 tons without the mountings

THE BUNNELL GUN TRINITY, N.Y.

A comparison of the length of the gun with the height of Trinity Church and steeple, New York



At a 70-mile range the gun's possible destructive area is 15,386 square miles; at 100-mile range, 31,400 square miles. We can imagine its projectile bounding over our highest mountains with ease

chloride of nitrogen. The second shell would be aimed at the same place and fired as quickly as possible to get the same atmospheric advantages, whereupon it would begin after landing to vomit innumerable small shells containing osmium and hydrocyanic acid, cyanogen, etc.

The silent death produced by osmium would make an ordinary graveyard tame and commonplace; for the osmium that can be piled on a ten cent silver piece will kill 1,000 persons. I have devised a shell which would contain enough of that poisonous metal to kill 300,000 people and 700,000 persons, respectively, allowing the usual 10% for failures, etc. The gas would travel in waves from a central point. The crest of each wave would be a terrible compression, and the bottom of each wave a fearful vacuum.

What's Wrong with the Big Gun

MR. BUNNELL, the author of the foregoing article, is one of the few laymen who has definitely attacked the problem of the big gun. He is an artist with an imagination, as his pictures and his article prove. We gave him space in the POPULAR SCIENCE MONTHLY to set forth his ideas. And now the Editor shall proceed to give his view of them.

The size of a gun cannot be increased without paying the price. The weight of a heavy gun, the projectile and the powder charge vary almost directly with the cube of the diameter of the bore. Hence a small increase in diameter means a very large increase in power. For example, a twelve-inch gun fires a shell which is about seventy-five per cent. heavier than that fired from a ten-inch gun; a fourteen-inch gun fires a shell about sixty per cent. heavier than that fired from a twelve-inch gun; and a sixteen-inch gun fires a shell half again as heavy as that fired by a fourteen-inch gun. A sixty-inch gun would be at least two hundred and fifty feet long; its shell would weigh about sixty tons; and the charge would be about twenty tons of powder. The weight of the gun itself would approximate that of the old battleship Oregon; the carriage would weigh twice as much.

Now it must be admitted that such a gun could be built. But are the existing facilities adequate for handling such an enormous mass in a single unit? We doubt it.

Consider the mere matter of machining the casting. The lathe to bore and rifle the gun would be not less than five hundred feet long—twenty times the length of any lathe ordinarily seen in a machine shop, except lathes built for very special purposes.

How would the completed gun be transported? Transportation by rail would be impossible in many places.

No doubt bigger guns than those we have now can be built. But the ordnance expert and the military strategist asks himself: Is it worth while spending the necessary time, energy and money? To justify its existence a huge gun such as that which Mr. Bunnell proposes would have to accomplish amazing results. In judging these results such factors as probable life, range, accuracy, rapidity of fire, character of the target and destructive effect of the projectile would have to be considered.

As the destructive effect of the projectile is approximately proportional to the weight, this is usually not a determining consideration, provided the projectile can destroy its probable target, which for heavy guns is usually considered as the most powerful battleship afloat or contemplated.

The range does not increase greatly with the caliber. At the usual maximum elevation the range of a sixteen-inch gun is only about a mile more than that of a similar ten-inch gun. A sixty-inch gun would have an appreciably greater range than a sixteen-inch gun, but not great enough to be a determining factor. The accuracy of fire would also not be appreciably greater. As a projectile not much heavier than the heaviest now in use could destroy anything now known or contemplated, the factors which would determine whether or not a sixty-inch gun should be built would be probable life, rapidity of fire and difficulty of construction.

The life of a gun decreases rapidly with the caliber; probably a dozen rounds fired from the Bunnell gun would mark the duration of its accuracy life—not enough to insure the destruction of a single target. With the best gunners the hits made are limited by accurate observation of fire, by the natural dispersion of shots, and in the case of ships, by unexpected changes of course.

The increase in size of guns has been a slow evolution. It is not likely that we shall suddenly leap to a titanic weapon.—EDITOR *Popular Science Monthly.*

You Can Hold a Dozen of These Perfect Coconuts in One Hand

THE coconut family is a large one, and there are many babies in it. The babies are a species all by themselves, though closely related to the giant seventy-pound specimens called *coco-de-mer*. As shown in the photograph they are full grown, although only as large as a good-sized hickory nut. Although they taste exactly like the ordinary coconut, they are too small to be of any value commercially and they rot on the ground by the ton, in the tropics. The same is true of the giant species which are too large for commercial purposes. Only the medium size is sold.

The baby coconuts are exactly like the larger-sized nuts in taste and texture

Making Money Out of a Nuisance. The Industrial Rise of Acetylene Ash

INDUSTRIAL chemists are constantly finding new and useful ways of disposing of by-products. One of the latest troublesome wastes to rise to the dignity of a valuable commercial product is acetylene ash. This stuff, which could not be disposed of profitably a short time ago, is now worth fifty dollars a ton.

An employe of a Los Angeles plant, Frank L. Thompson, discovered that it could be used to make plaster, whitewash and a substitute for marble dust that is used in the surfacing of asphalt highways.

Dissolved acetylene gas is made from calcium carbide, which is a combination of plain lime and carbon. The product that remains after the gas has been extracted is slaked lime of a decided commercial value.

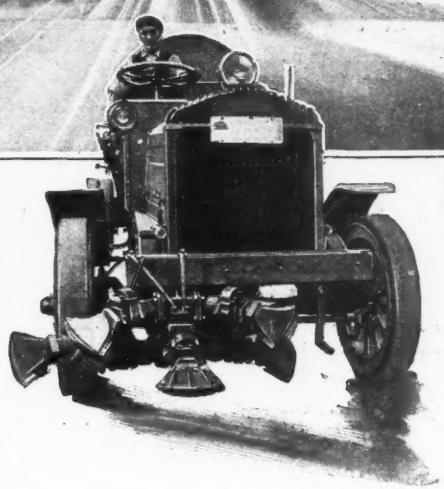
The French "Horizon Blue" Is the Best Color for Uniforms

OUR khaki suits are good. But "horizon blue," the color which the French use for their uniforms, is said to be better still. Against certain backgrounds it is altogether invisible from a distance. The reason for this is that it is the color of distance. An artist painting a landscape puts his objects "back" by washing them over with a mixture of white and blue, the horizon blue. This makes it appear as if there were air between the objects and our eyes, so that the objects themselves appear indistinct.

The uniforms of horizon blue make the wearers appear, if not actually a part of the landscape, at least considerably farther away than they are. And since a man is recognized by his shape rather than by his color, the blending of his clothes with the color of the horizon helps his "camouflage considerably."

Digging acetylene ash from a sludge pit filled with lime from a Los Angeles acetylene plant and whitewashing a fence with whitewash made from acetylene sludge

The five flusher-nozzles at the front of the truck swing on a vertical pivot



It is possible to flush either a small portion or an entire sixty-foot street

The five flusher-nozzles shown at the front of the truck may be swung to flush a portion or the entire width of a sixty-foot street in one operation.

Exit the Old Horse Water-Wagon. Enter the Powerful Motor Sprinkler and Flusher

THE new type of motor sprinkler and flusher shown in the illustrations above carries twice as much water as a horse-drawn outfit, travels twice as fast, sprinkles or flushes twice the area in any given time and at three-quarters the cost. In a word it combines the work and efficiency of two vehicles. The motor-flushed or sprinkled street is better cleaned because the speed is uniform and because the water pressure is constantly maintained at the proper point by means of the truck mechanism.

The motor unit illustrated carries a twelve-hundred-gallon tank of water which flows to a two-stage centrifugal water pump inserted into the truck drive-shaft behind the speed-controlling gearset. Thus the pressure of the water is controlled in conformity with the vehicle's speed, so that too much is not furnished now and too little later, which happens with the horse water-wagon. The pressure is varied to suit particular conditions of the street pavement by manipulation of the nozzle openings controlled by a lever from the driver's seat.

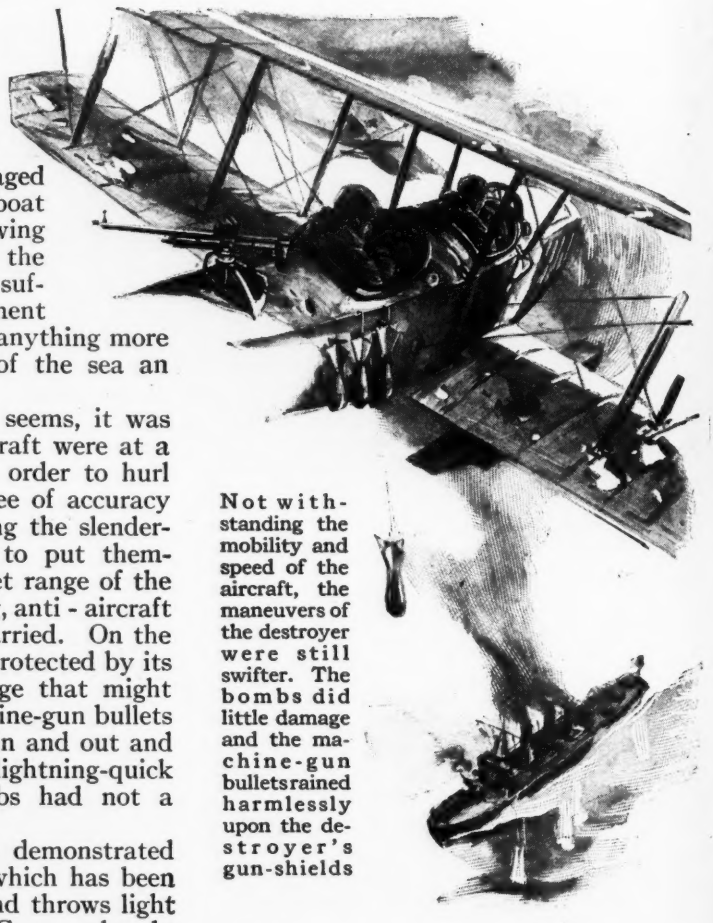
Of What Use Is the Best Gun with Defective Ammunition?

SUPPOSE that a machine-gun is supplied with ammunition which is one per cent defective. That does not seem very serious. One per cent is such a small factor. But consider the question a bit more closely. A machine-gun fires 1000 shots a minute. Defective ammunition will cause the gun to jam. It takes at least ten seconds to straighten out each jam. One per cent of 1000 is 10. Ten jams, each taking ten seconds to straighten out, would require 100 seconds of work. Instead of delivering 1000 shots a minute the machine-gun with the one per cent defective ammunition would be consuming almost two minutes in getting rid of the jams. It is evident that in two minutes' time, it would be possible for the side having poor ammunition to lose a position of great strategic value.

An Entire Air Fleet versus One Destroyer

There were sixteen German aircraft, but the little destroyer held its own against them

THE airplane has met a worthy foe in the modern torpedo boat destroyer. In a recent thrilling battle, a whole fleet of German planes, sixteen in all, engaged a single Russian torpedo boat destroyer. Instead of blowing the little destroyer up with the first bomb dropped, they suffered considerable punishment themselves and failed to do anything more than give the little wasp of the sea an exciting time.



Notwithstanding the mobility and speed of the aircraft, the maneuvers of the destroyer were still swifter. The bombs did little damage and the machine-gun bullets rained harmlessly upon the destroyer's gun-shields

One-sided as the contest seems, it was not so in reality. The aircraft were at a constant disadvantage. In order to hurl their bombs with any degree of accuracy or with any hope of affecting the slender-hulled destroyer, they had to put themselves within excellent target range of the heavy-caliber, quick-firing, anti-aircraft guns which the destroyer carried. On the other hand, the destroyer, protected by its gun-shields from the damage that might have been done by the machine-gun bullets from the airplanes, darted in and out and round about with such lightning-quick maneuvers, that the bombs had not a chance to do any damage.

This battle incidentally demonstrated an essential improvement which has been made in airplane tactics, and throws light upon recent maneuvers of German bombing expeditions. The improvement concerns a system of inter-communication which has been established, by means of which an "admiral" of an air fleet can keep his battleplane fleet as well in hand as does the commander of the naval force. Without such intercommunication the sixteen planes would merely have "shuffled" around one another, doing more damage to their fleet, perhaps, by collisions than their bombs and machine guns could have done to the destroyer. The battleplanes are now able to receive as well as send wireless messages notwithstanding the roar of the motors. The attack in question undoubtedly required some definite formation by means of which the greatest number of bombs could be concentrated on the smallest space in the least time. and yet not offer a massed flock of airplanes to the destroyer's guns. This would necessitate very rapid shifting, in which the whole fleet would move as one in accordance with a general plan, yet each one acting independently to meet unforeseen conditions. This would require uninterrupted wireless communication.

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This New Motor-Truck Kitchen Serves Meals to 2,000 Daily

A NEW type of United States Army steam field kitchen has just been designed to furnish a battalion of 2,000 men three hot meals a day. The new outfit is mounted on a four-ton motor truck to enable it to accompany the troops on marches and even move ahead of them so that their meals will be ready when they halt for the noon lunch period or at night.

The great capacity of the equipment is its principal feature. This is directly attributable to the use of a ten-horsepower vertical boiler which furnishes live steam at fifty pounds pressure to two fifty-gallon coffee urns and two ninety-gallon stew, soup or pot-roast kettles. The boiler is arranged to burn coal, wood or oil, and the kettles and urns are of the steam-jacketed type which can raise water from 62 degrees Fahrenheit to 212 degrees in six minutes.

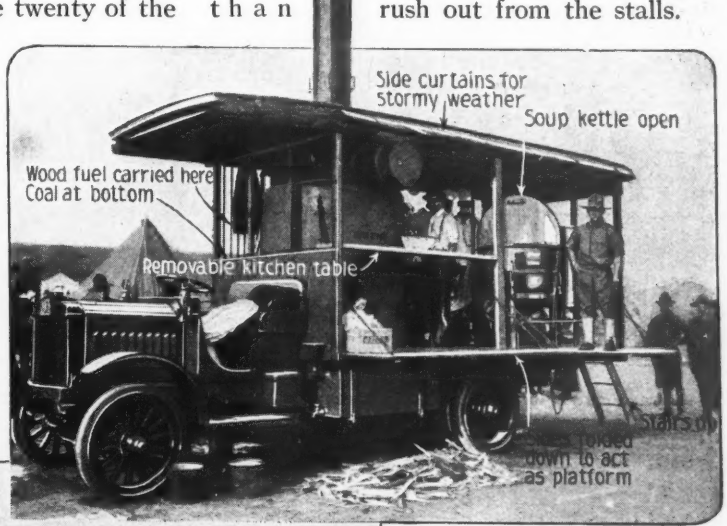
The kitchen can be run by two cooks and the motor truck driver. The outfit and these three men replace twenty of the ordinary army field kitchens which require eighty men and forty horses or mules for their operation, and are slow-moving as well as lacking in facilities for serving quick meals in large quantities.

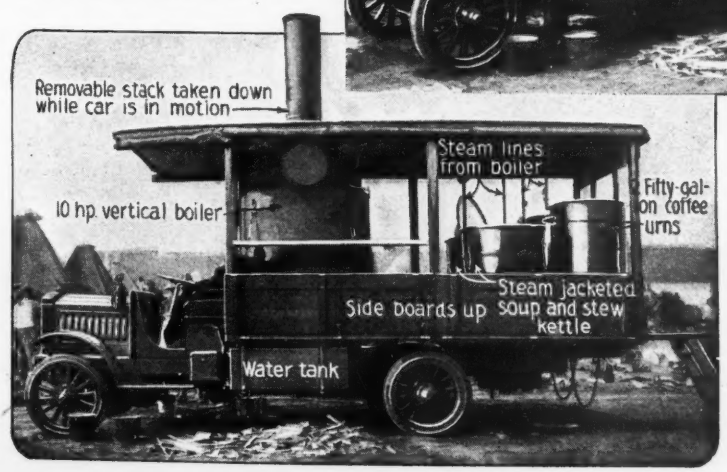
The new outfit is the invention of J. C. LaVin, manager of the Hotel Taft, New Haven, Conn., and is known as the Taft army kitchen.

Some of the Eccentricities of a Sleeping Horse

HORSES seldom lie down to sleep. Throughout their entire lives most of them sleep while standing on their feet. The reason for this is believed to be that the horses are afraid that an insect might crawl into their nostrils. This is a very likely explanation when we consider that a horse's nostrils are the most sensitive part of his body. If the insect could not be removed, it could easily irritate a horse to death. Many horses will not lie down because they have once been "foundered," that is, unable to get up unassisted.

Another curious fact about a sleeping horse is that he seems always to keep his faculties working. His ears, for instance, keep constantly twitching and he seems to hear the slightest noise. Because of this, it would probably be impossible for a man to enter a stable quietly enough to prevent his waking up every horse in it. Horses act peculiarly also in time of fire. They will burn to death rather than rush out from the stalls.

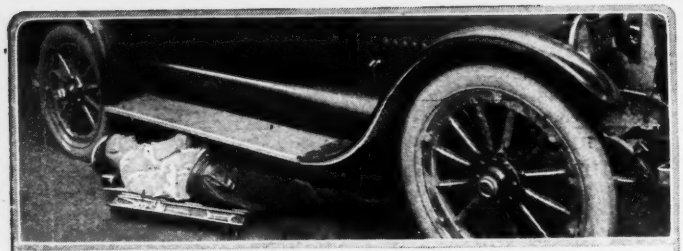



Removable stack taken down while car is in motion
Steam lines from boiler
10 hp. vertical boiler
Fifty-gallon coffee urns
Steam jacketed soup and stew kettle
Side boards up
Water tank

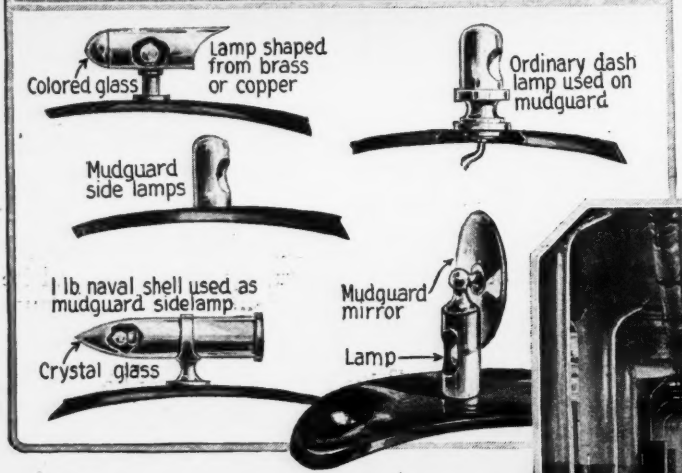
The boiler of the motor field kitchen is arranged to be run by coal, wood or oil. Three men operate the entire apparatus

The great ten-horsepower vertical boiler furnishes live steam to two fifty-gallon coffee pots and two ninety-gallon soup kettles

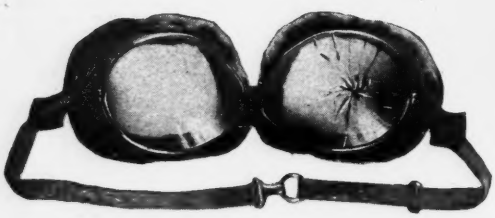
What's New in Automobile Accessories?



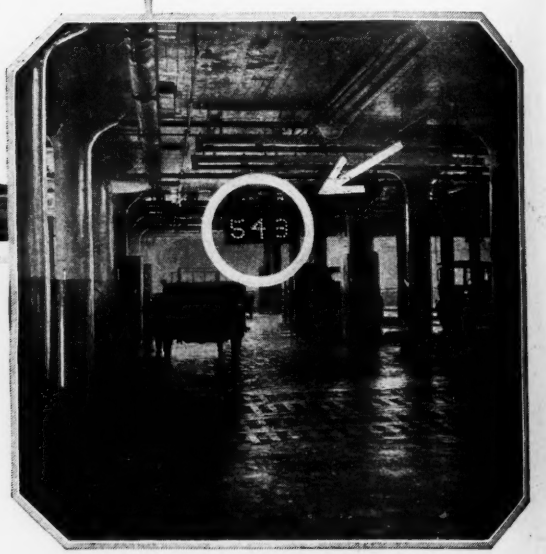
A creeper having a light frame with upholstered head rest and mounted on ball bearing wheels so that it is easily run beneath an automobile or truck



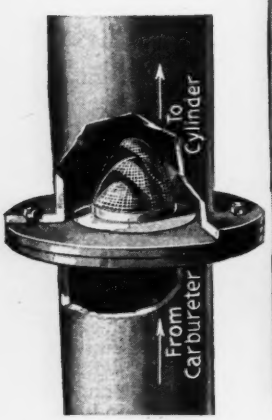
Electric mudguard side lamps of original design shown at the left. When they are placed far out on the mudguards the width of the automobile overall is shown



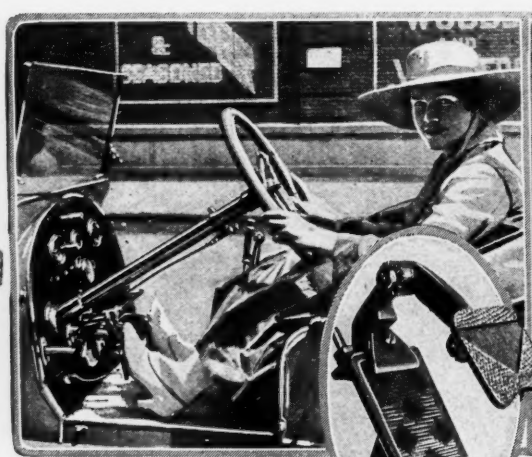
Unbreakable goggles having two layers of optical glass separated by one of celluloid



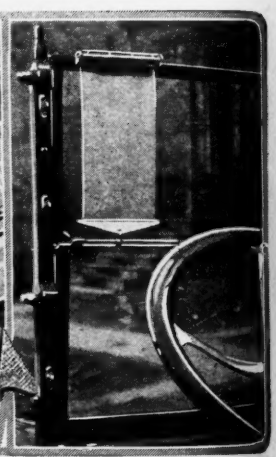
Electric-lighted numbers operated from the garage office to call chauffeurs to the telephone



Fly-trap gauze gasket to break up the gasoline properly



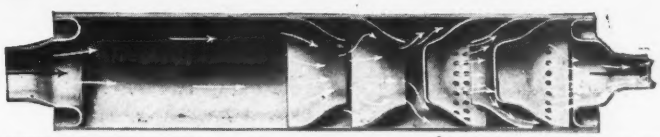
Extension on the pedals, useful to the short-legged driver



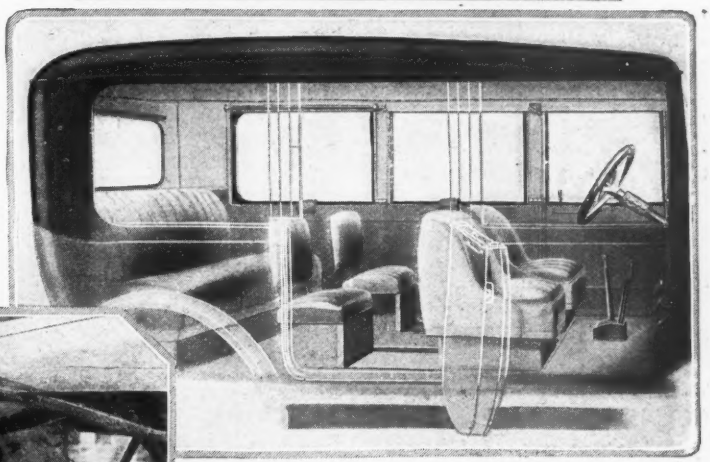
A roller shade made of colored celluloid to stop glare

What's New in Automobile Accessories?

A new muffler that contracts and expands in order to exhaust gases from the automobile engine. It passes them through a series of bell-shaped stampings at the exhaust end to reduce the noise

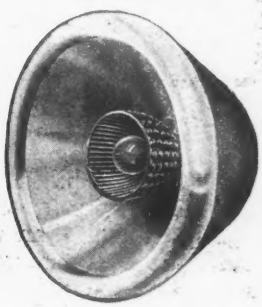


At left: A staggered door arrangement. The driver enters on the left side. The door for the passengers is set in the center of the right side. This keeps the driver from passing in front of the passengers to get to his seat



A chemically prepared cloth with which to rub a wind shield to prevent rain from dimming the glass

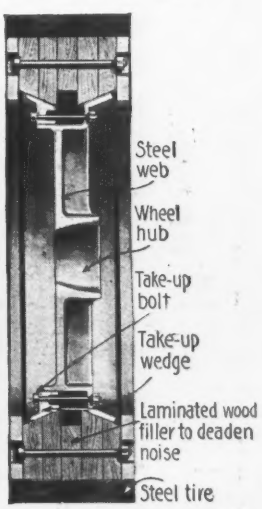
The needle of this compass has luminous ends so that it may be used by automobilists at night



This auxiliary lens applied to any automobile lamp will make a flood of light without any glare

This steering post holster is for use on the police detective's car

A rain cape for emergency use. It can be carried in the tool box and may be used to protect passengers as well as upholstery



A laminated wood wheel with a steel tire for steam wagons

How Merchant Ships Hide Themselves from Submarines

WHEN the sinister little periscope of a submarine is sighted aboard a merchant ship an order is given to throw out the smoke boxes. These boxes contain material which, when burning, gives off dense clouds of black smoke, completely screening the vessel from the attacking submarine.

The smoke boxes are about two feet square and are filled with oakum, waste, or other inflammable stuff soaked with hydrocarbon material that will give off heavy black smoke when ignited. The exact nature of the material used is a secret.

The smoke screen rising from the ignited waste in the smoke-boxes hides the ship

One box which has been used very successfully has a top slightly smaller than the opening it is to cover. It is supported by means of lugs fastened on the inside of the box. The intervening space between the top and the edge of the box is covered with a piece of adhesive tape which contains a part of the igniting mixture. The match or fuse which sets fire to the contents of the box is placed at one corner and projects slightly through the slit.

When the order comes to hurl the smoke boxes overboard the sailor grasps the tape and throws the box into the sea. The friction of the adhesive tape across the fuse ignites it in much the same way as you light a safety match by striking it on the box. The fuse carries the flame to the interior of the box and sets the inflammable material afire. The slit around the top causes the smoke to spread out freely.

Several of these boxes are lighted and thrown overboard at the same time. They create such a dense cloud of smoke that the vessel can make her escape before the submarine can launch her torpedo.

Plenty of Rice for Food and Face Powder!

AMERICAN women may powder their faces in comfort without fearing that they are robbing the Allies of food. For some unknown reason people generally prefer to use the white, polished rice, rather than the more wholesome brown rice.

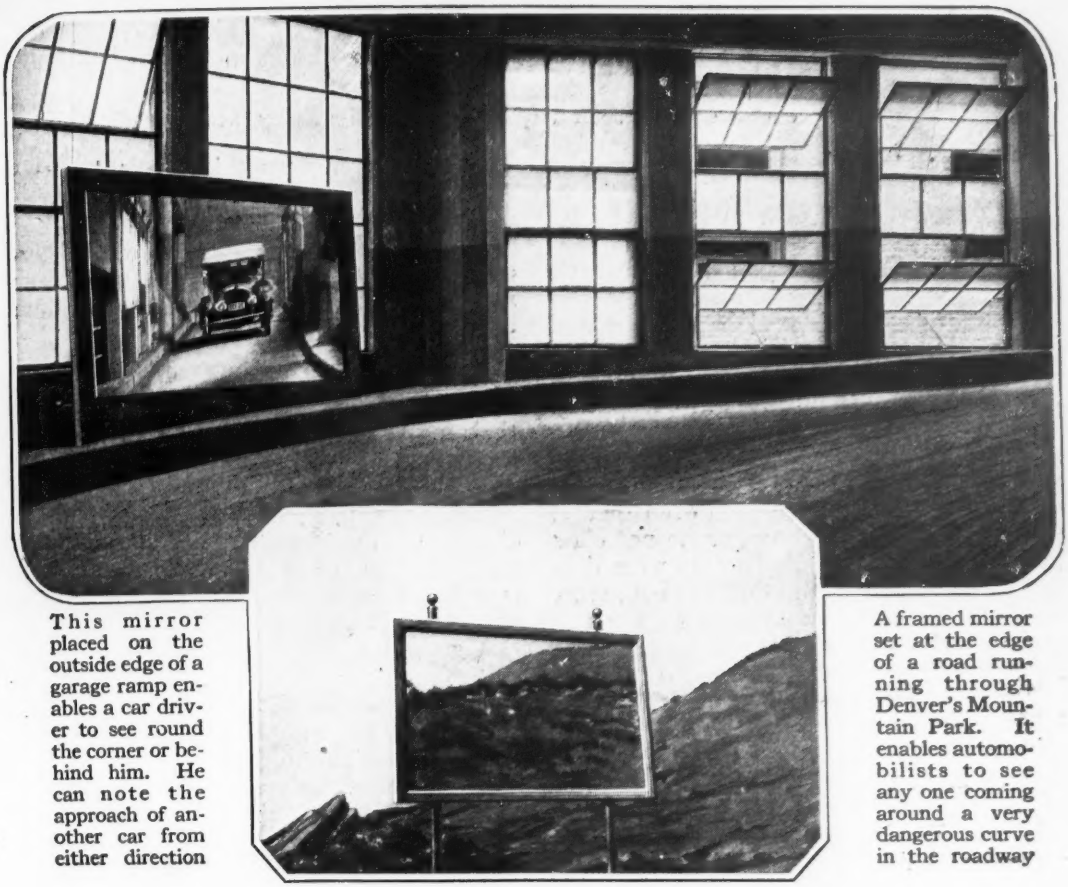
When rice is polished it is first hulled, then scoured to remove the bran and cuticle. Every barrel of rice loses about six pounds in this process. The "polish" as the hull and bran are called, is sold for cattle food at three-fourths of a cent a pound. Some of it is pulverized and sold as cosmetic powder.

A Disappearing Crutch. It Telescope to Scabbard Length

A NEW crutch has made its appearance in London which may be worn on a belt. The legs are made of telescopic tubular steel and may be adjusted to any height or locked into the first section, when the wearer is seated.

© Int. Film Serv.

A new crutch for British soldiers. The legs are made of tubular telescopic steel fitted to a belt



This mirror placed on the outside edge of a garage ramp enables a car driver to see round the corner or behind him. He can note the approach of another car from either direction

A framed mirror set at the edge of a road running through Denver's Mountain Park. It enables automobilists to see any one coming around a very dangerous curve in the roadway

Is the Coast Clear for Your Car? Look in the Mirror and See

EVERYONE who has ever driven an automobile knows how often danger lurks just round the corner. A man who had often longed for the ability to see at the same time round the corners ahead of him and what was coming behind him devised a method of arranging a mirror so this could be accomplished.

By placing a large framed mirror on the outside edge of a curved road or a curved ramp the driver of an automobile approaching the mirror in either direction is enabled to see whether there is danger ahead or behind.

The mirror must be large enough to serve the purpose and must be held in a stout frame. If the frame is strong enough, ordinary shocks will not injure the glass. Such mirrors placed at dangerous curves on highways would greatly reduce the number of accidents which are always the toll exacted by sharp curves.

Two Billion Paving Bricks a Year From Furnace Slag

AT a meeting of the American Ceramic Society, Mr. J. B. Shaw of Alfred, N. Y., told of some very successful tests he had made in producing paving brick from blast furnace slag. These bricks are worth about $35 per thousand. They may be successfully made of almost any blast furnace slag at a cost of five to seven dollars per thousand. He figures that there is at present available about 16,000,000 tons of slag annually in the United States after leaving 2,000,000 tons for cement manufacture. This would provide about two billion bricks for permanent good roads every year—say for laying 1,000 miles annually of fifty-foot road.

The oft-repeated attempts to solve this problem seem to have met success now. The slag must be treated hot as it comes from the furnace and the brick must be heated out of contact with air or steam lest it become brittle.—ELLWOOD HENDRICK.

Showing Mars the Moving Pictures

Reflections on the invention of a giant screen which can be seen a quarter of a mile away

EDITOR: "Good morning, have you invented anything today?"

READER: "Can't seem to think of anything."

EDITOR: "Perhaps you need a little encouragement. First of all examine casually some great invention. If you find you are unable, offhand, to change or improve its function, just change its size. Make it enormous, gigantic, awe-inspiring. Why? Don't ask questions. Apply for a patent at once. When the patent bearing your name and the names of the humble witnesses is issued, keep calm even though manufacturers and promoters do not claw at one another and fill the air with desperate wailings in their efforts to buy, rent, promote or steal your patent. Console yourself with the fact that the world has not as yet been educated up to your method.

This imaginary conversation is inspired by the contemplation of a recently issued patent which discloses nothing more than a moving picture screen so large that it will require four or five projection machines to fill it up. We daresay the glittering path of success will shortly dazzle the inventor.

The advantages so great a picture possesses are not divulged. We have a suspicion that the inventor has a scheme which will make it possible to assemble an audience on Mars who will shoot the customary price of admission into the exhibitor's cash register.

The method for displaying this huge picture is simple. Procure a screen about four times larger than any at present employed. Raising the roofs of picture theaters to accommodate the screen is a matter hardly worth mentioning. Next induce photoplay producers to employ four photographers to take the scenes. Each photographer will take one-quarter section of the picture; one man to photograph the upper right section, another the upper left, etc. The sections must be taken in such a manner that when they are displayed simultaneously on the screen by four projection machines, they will all meet properly. You have often done this very thing as a child when you pieced together a rhinoceros or zebra with four spelling blocks.

A little care should be exercised, however, in the taking of these films. The four men should be instructed to grind in time and at the same speed.

In displaying the picture, only four operators and assistants are required who will be instructed to keep an even pace for their individual sections. It would not do for the operator who is showing the head and body of the beautiful heroine to run his machine slowly, while the operator who has charge of the feet projection runs his machine fast. No, indeed. Her elbows may just then be on the dinner table while her feet walk off to the ballroom scene.

A good operator can also be trained to understand the necessity of keeping the head section of the picture in the upper part of the screen. The feet should do their accompanying shuffling underneath.

A very ingenious method for camouflaging the lines on the screen where the four sectional pictures meet, has also been devised by the inventor. These edges form a cross directly in the center of the picture field. Permanently painting a tree, window or telegraph pole over these lines will effectually eliminate the meeting edges of the four picture sections and will in no way detract from the enacted scene. Only a carping critic would object to viewing a play through the branches of a tree. What if the tree does appear in the kitchen scene? The effect is not necessarily spoiled because you are unaccustomed to seeing it there.

Anyone intending to embark in this gigantic motion-picture enterprise should not forget that the nearest seat to the screen from which a fairly good view can be had, will be about one hundred feet distant. This slight loss in seating capacity is more than compensated for by the fact that the screen can be viewed at a distance of about one-quarter of a mile. This will permit the extension of the theater seats out on to the sidewalk, and across the street.

Those of us interested in science, engineering, invention form a kind of guild. We should help one another. All the specialized knowledge and information of the editorial staff of the Popular Science Monthly is at your disposal. Write to the editor if you think he can help you. He is willing to answer questions.

Two British airplanes in Mesopotamia. They are covered with matting woven by the natives to protect them from the rays of the sun. The matting also acts as camouflage

The Sun Is an Enemy of Airplanes in Mesopotamia

AIRPLANES are being used in Mesopotamia just as they are in other theaters of war. The British find that the eyes of the army are as much needed to see over the sun-baked desert where they are fighting the Turks as they are in France. The natural conditions in Mesopotamia are very hard on the military airplane.

There is no moisture in that country. The air is very dry. This would be an ideal condition for airplanes if it were not for the intense heat of the sun. Long rainy spells make great trouble for aviators in Europe because the moisture causes the wood used in the machines to warp. In Mesopotamia this difficulty does not exist; but the large expanse of horizontal surface offered by the planes absorbs the sun's heat as a sponge absorbs water. The planes become so hot that you could literally cook an egg on them. This naturally has a bad effect on both the wood and the canvas used in the planes.

While the planes are in flight the coolness of the upper air and the gale that sweeps across the desert keep them comparatively cool. It is when they are at rest on the ground where the temperature is so very high that the damage is done by the sun. The natives of Mesopotamia weave a pliable, fine matting. The British use this matting as a covering for their military airplanes. It not only acts as an ideal protection from the rays of the sun but makes the planes invisible to the enemy.

A Perfect Shoe-Blacking Kit—It's All in the Brush

THE Army and Navy boys are not the only ones who will appreciate this novel shoe-blacking kit.

It contains a tube of paste which is securely capped and held on top of the brush in a sliding groove. You slide the brush forward, take off the cap, twist a key to deposit a small amount of the paste directly on the shoe, then put the cap back on the tube and slide the tube back in place. Then you turn the brush over and polish the shoe with the bristles until the paste is well spread. At the end opposite the bristles there is a piece of lamb's wool for polishing. A light rub with this produces a mirror-like polish. After the operation you slip the whole thing into a little bag, pull the drawstring and put it away anywhere you choose to keep it until the next time. It will not soil anything with which it comes in contact.

Turn the key and just the right amount of polish drops out of the tube. Then slide the tube back in its groove and polish with bristles and lamb's wool

Blinding the Enemy with Searchlights

While the searchlights, concentrated on the Austrian position, streamed above, the Italian engineers worked below in pitch dark, bridging the chasm between the opposing forces. They had to drop their pontoons down a forty-foot wall on wooden skids, join them, and plank them over a wildly rushing stream. The Austrians, flooded in noon-day light, could see nothing in the darkness beyond. They suspected a ruse and kept their guns booming but this only covered the noise of bridge building

"Let There Be Light—Enough to Blind the Enemy," Said Cadorna

THERE have been thrilling happenings galore in this war of wonders, but nothing more dramatic has been reported than the manner in which the Italians under Cadorna, by a piece of engineering daredeviltry, crossed a great gorge in the Alps and brought their troops, guns and entire equipment right up under the Austrians' noses without losing a man.

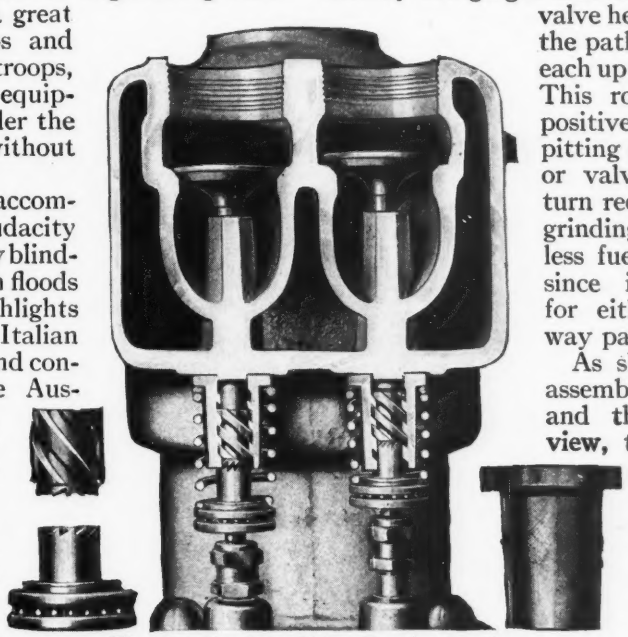
The feat was accomplished by sheer audacity—made possible by blinding the enemy with floods of light from searchlights strung along the Italian side of the gorge and concentrated on the Austrians all during the momentous night, so that they were unable to see what the Italians were doing. When the morning dawned, the sun revealed a number of bridges which the daring Italians had erected over the terrible chasm during the night.

Naturally the Austrians suspected that something was going on while the powerful searchlights were making noonday glare all around them and leaving the Italians and the surrounding country wrapped in midnight blackness. They fired their guns ceaselessly, but the booming only served to conceal the noise of the bridge-building.

The engineers had to drop their pontoon boats down a forty-foot wall on wooden skids, then join them across as treacherous a stream of running water as was ever encountered anywhere, plank them over so that the troops could cross, and provide ladders to enable the troops to scale the precipice on the Austrian side. Time and again the current swept the boats away before they were properly joined. But in the morning the Austrians fell back in consternation before the entire Italian unit, not a hundred yards away.

Turning Valves on Their Seats Automatically

A SIMPLE device has just been designed and patented for the purpose of automatically rotating the valves of gas engines on their seats while the motors are running, thereby bringing a different portion of the valve head and stem into the path of the flame on each up and down stroke. This rotative action is positive and reduces the pitting on the valve seat or valve head, this in turn requiring less valve grinding and making for less fuel and oil wasted, since it is impossible for either to work its way past the valve seat.



The Details of the Valve-Turning Device

The valve-rotator consists of four main parts: a threaded boss slipped over the valve stem near the bottom; a hollow sleeve rigidly attached to the cylinder water-jacket and internally threaded to fit the thread of the boss; a ball-bearing joint the bottom half of which is attached to the valve push-rod and the upper half of which has a small projection with saw teeth to contact similar teeth on the bottom of the boss around the valve stem; and a coil-spring between the hollow sleeve and the ball-bearing joint

As shown in the disassembled unit pictured and the cross-sectional view, the valve rotator consists of four main parts, a threaded boss slipped over the valve stem near the bottom; a hollow sleeve rigidly attached to the cylinder water-jacket and internally threaded to fit the thread of the boss; a ball-bearing joint the bottom half of which is attached to the valve push-rod and the upper half of which has a small projection with saw teeth to contact with similar teeth on the bottom of the boss around the valve stem; and a coil-spring between the hollow sleeve and the ball-bearing joint.

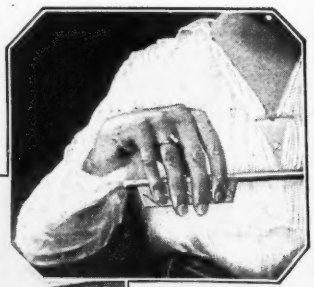
In operation, the upward movement of the valve push-rod causes the teeth in the ball-bearing joint member to mesh with those on the bottom of the boss, the angularity of the teeth tending to cause the valve stem to move round against the resistance of the coil-spring. As the valve stem drops, the spring brings the ball-bearing joint back to its original position as the teeth are withdrawn from mesh. The next upward movement forces the valve round on its seat a little more until by a succeeding upward stroke it has made a complete revolution on its seat.

Learning the Violin Without an Instrument

Knobbed sticks are used to teach the fingering

The substitute violin and bow used in the Mitchell method of violin instruction, and on which the students learn to play without going to the expense of purchasing an instrument for practise work

A class of violin teachers at New York University learning the Mitchell method of violin instruction. The fingerboard chart on the blackboard shows the exact position of the sounds on a regular violin fingerboard



Showing how the bow should be held. The fingers are rounded and unstiffened. The axis of the wrist joint (an imaginary line running across the wrist) should be parallel with the bow

In circle: The fingerboard on the substitute violin. The little knobs teach the pupil just where to place his fingers in order to produce the different notes

FROM the day when Nero fiddled to a burning Rome up to the present time the only way any one learned to play the violin was by getting one and employing the services of an instructor. Now all that is changed. Dr. Albert G. Mitchell, of New York University, has devised a method whereby an entire class learns to play the violin at once. And the strangest part of the Mitchell method is that in the beginning, the class does not use a violin at all.

The pupils are taught the correct position for the bow and the fingering on the violin by means of an imitation violin and an imitation bow. The substitute for the violin is a straight piece of wood with little knobs at the top to indicate the places where the fingers should rest in order to produce the various notes. The pupil learns to use the bow in the proper place because there are two small pieces of wood fastened to the imitation violin between which the bow must pass. If it is not handled correctly it will break.

Learning how to use the violin bow. The two short pieces of wood nailed on the substitute violin act as guides for the bow. It is impossible to use the bow in the wrong manner when this method is employed

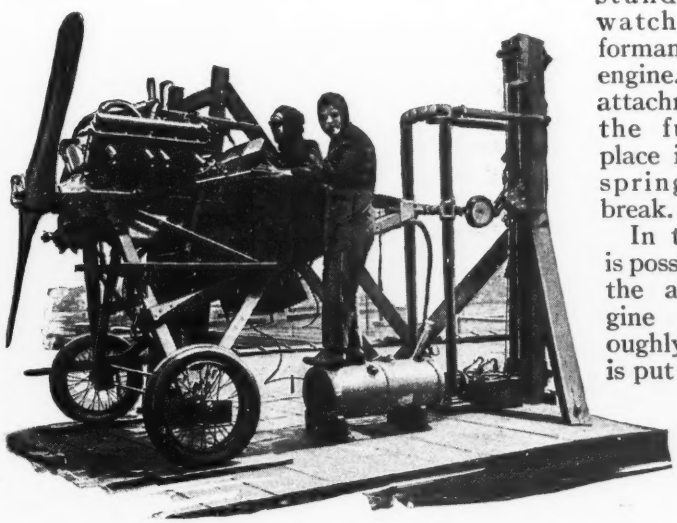
A large fingerboard chart is drawn on a blackboard so all the pupils can see it. Dr. Mitchell's class at the university is conducted for teachers of the violin. They learn the method and are then able to instruct large classes of children.

How Airplane Engines Are Tested at the Factory

PROBABLY nothing that is made in our factories to-day is tested more carefully than an airplane. An airplane has not the solidity of an automobile or of a power boat. It is very light and elastic. Yet it calls for a high power engine. To put a hundred horsepower engine in an airplane without first testing it would be to invite disaster. An engine that gives an ideal performance when on a bedplate securely bolted to the factory floor might be trusted in the solid chassis of an automobile or the substantial hull of a launch but never in the flimsy, vibrating fuselage of an airplane.

Where airplane motors are made in large numbers it is not practicable to test them in actual fuselages because the fuselages would deteriorate too rapidly. Therefore a good imitation fuselage has been designed to meet the needs of the engine makers. This is made of angle iron and rests on real airplane wheels. The motor is controlled from a regular pilot's seat. The water jackets are connected with water mains by flexible hose resting on a separate wooden frame.

It is not at all difficult to test an airplane motor because the propeller is its flywheel and it is only necessary to ascertain whether or not it keeps up a standard amount of pull and works steadily. This is measured by a simple spring balance. The engine must be tested also, to determine how it is affected by inclining it up or down as it must be inclined when flying. This test is accomplished by hooking the spring balance lower or higher to a massive post behind the testing fuselage. While the pilot controls the motor a mechanician stands by to watch the performance of the engine. A safety attachment holds the fuselage in place in case the spring should break.



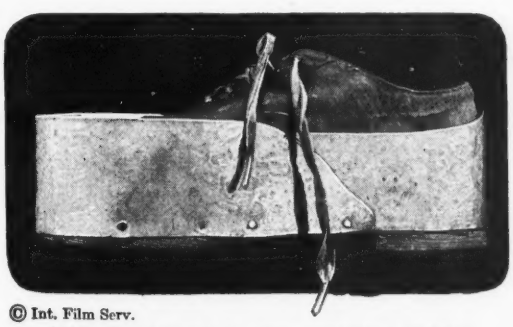
Testing an airplane engine by means of an imitation stationary fuselage made of angle iron mounted on airplane wheels

In this way it is possible to test the airplane engine very thoroughly before it is put into service in the air, without endangering the lives of the workmen.

Protecting Your Shoes from Mud—in War Gardens or Trenches

THE patriotic citizens who planted and tended war gardens in response to the urgent advice of the Government during the past year, found that weeding is best accomplished after a rain, when the ground is soft and yielding. The housewives had to learn something too in the line of patience, which was needed when so much cleaning up had to be done on account of the gardeners coming indoors with their muddy feet.

I. E. Harris, an employee in the Census Office, in Washington, D. C., found a way to protect his shoes from the mud so that when he came in out of the garden there would be no tracks for the housewife to complain about. He designed a garden shoe with canvas upper and wooden sole and around the sole he shaped a piece of zinc, tacking it to the sole. He has offered his idea to the Government.



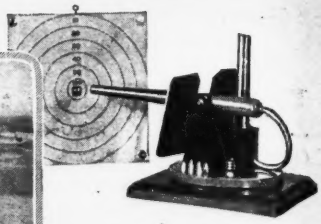
© Int. Film Serv.

This wooden-soled, zinc protected gardening shoe may serve our trench-fighters

The Latest Playthings from

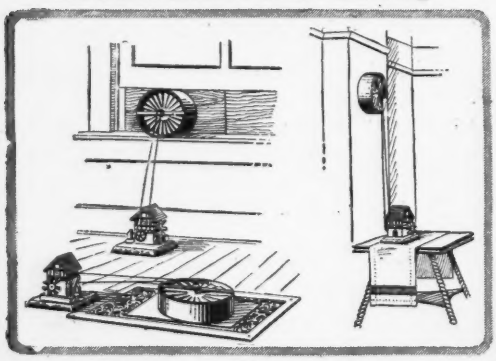
This bunny leaps six inches in the air every time the wheels go 'round. This is because the hind wheels are so high

Trench warfare is possible all the year with this outfit, at the seashore or in the back yard



Every time you shoot this pneumatic cannon you see a puff of talcum powder smoke

A small tablet of soap in the end makes bubbles within bubbles



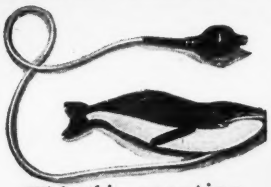
Connect this turbine with a toy and let the wind turn it

Folding sides turn this wagon into a coaster whenever you wish

No real, live clown in a circus can do better tricks than this little tumbler

Not a real cat toying with a mouse. Just a decorated wheeelbarrow

Santa Claus's Mechanical Toyshop



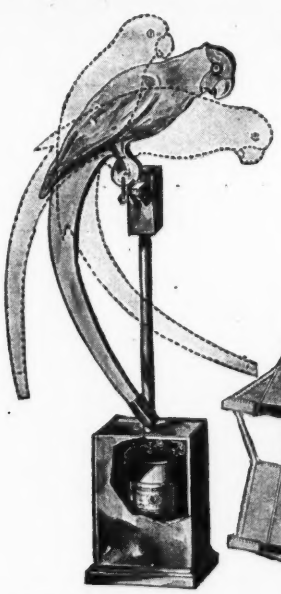
With this spouting whale the baby can amuse himself during his bath. Pressure on the bulb causes the water to spout from the head of the whale

This imitation automobile has rockers instead of wheels so that it is really merely an improvement on the old rocking horse

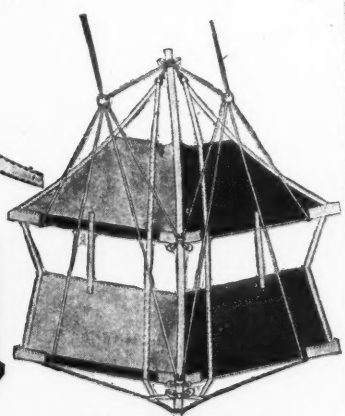
Hold this monoplane as far up as you can reach and then let it go. It will fly and volplane

Any boy can be a motion picture director if he has this machine. It generates its own gas and uses standard film

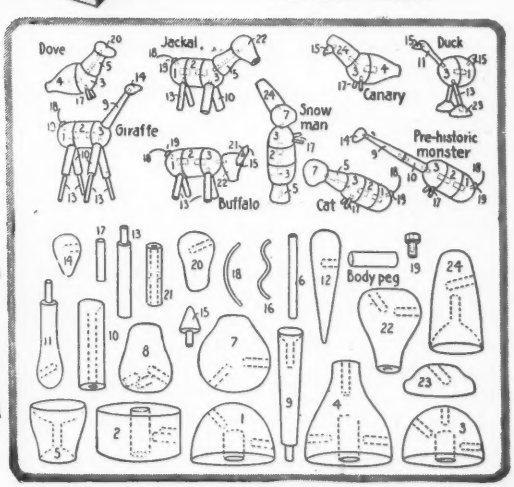
Children can have a beautiful time safely attached to the center post of this new rocker



The dry cell below furnishes power that swings the bird



This airplane loops the loop and performs other feats

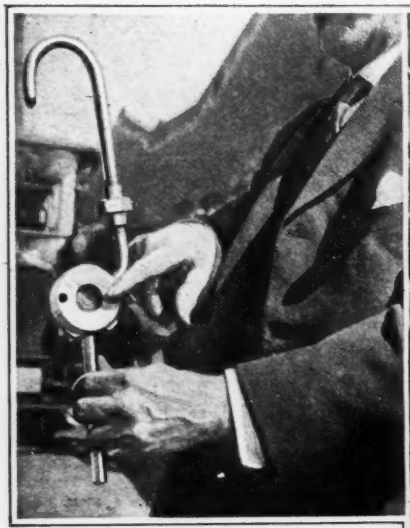


The numbered parts of these blocks fit together to make queer-looking animals. They are instructive in several ways

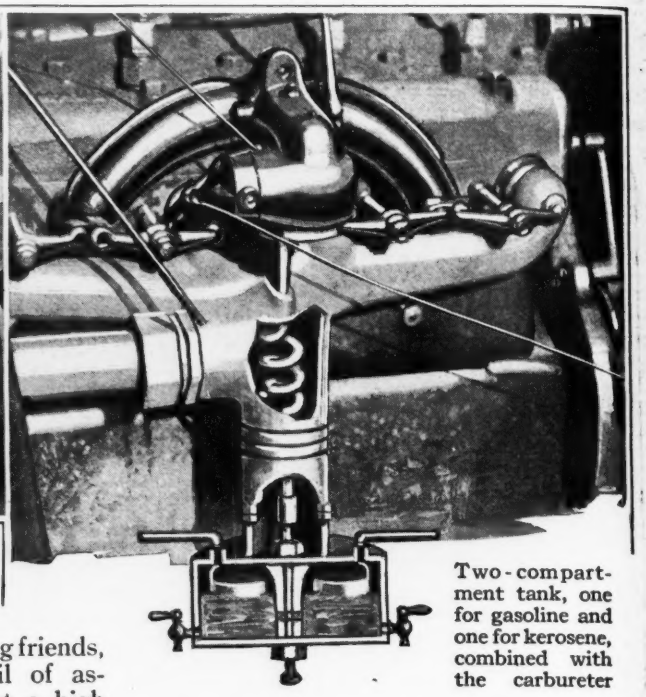
Burning Distillate in Your Automobile Engine

Something the East can learn from the West

By Edward C. Crossman



Electric heated carbureter for heavy fuel oils to start engine when cold



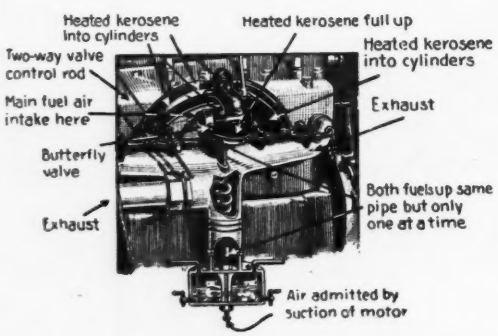
Two-compartment tank, one for gasoline and one for kerosene, combined with the carbureter

ACCORDING to my oil refining friends, when you distill crude oil of asphaltum base, you get first a high test gasoline, then a lower grade gasoline, and so on down until between kerosene and gasoline, you get what is known as "distillate." It looks, acts and smells much like gasoline, but costs much less.

Distillate is being used by too many business firms with flocks of delivery and salesman cars to be condemned as merely a passing fad.

Its fatal weakness is that it will not start a cold engine, and inasmuch as gas engines until they have started, are cold, the distillate is useless until some other method is used of turning over the engine and getting enough heat into the walls to make distillate vapor stop condensing on the way up the intake manifold. So owners burning distillate either in regular carbureters or in the many patent devices for utilizing the fuel, have to start on gasoline.

On the Pacific Coast, car drivers overcome by various means the reluctance of distillate to vaporize and to give power in a cold engine. The first means is a powerful starting and high compression motor, the combination developing heat through mere compression alone like a Diesel engine, until the distillate begins to fire. The second is by water-jacketing the intake manifold with the heated water from the cylinder cooling system and heating it again by paralleling it to the exhaust manifold.


Heated kerosene into cylinders
Heated kerosene full up
Heated kerosene into cylinders
Two-way valve control rod
Main fuel air intake here
Exhaust
Butterfly valve
Both fuels up same pipe but only one at a time
Exhaust
Air admitted by suction of motor

Details of the double tank carbureter and heating arrangement using kerosene for fuel

It is a common scheme in California to burn half distillate and half gasoline, making a mixture

costing fifteen cents per gallon, which is said to start easily and to develop even more power than the straight gas. Distillate works fairly well in pure form in the ordinary gas engine equipment, and very well in the higher grade, which costs twelve cents per gallon.

Distillate vapor will not ignite from the electric spark in a cold engine, unless it is of a high grade, approaching gasoline, like the twelve-cent grade. The mixture is too heavy and oily, and will not take fire from the tiny spark, but if you draw it into a hot cylinder it breaks down into an explosive mixture the instant it strikes the hot walls. Then the spark starts something.

So, roughly speaking, the patented distillate burning devices for the gas engine—chiefly for Fords—consist first of some form of stove or coil heated by the exhaust manifold, and so heating either the vapor taken into the carbureter or else the vapor after it comes out; and second of an auxiliary gasoline tank over the engine or on the dash to hold a little gasoline by which to start the engine in the chill of the morning. A valve is turned, admitting gasoline to the intake manifold or to the carbureter; the engine is started; then the valve is closed again, letting the distillate take up its labors for the day.

One weak point of this device is that the carbureter is full of distillate, and, if the gas is taken into the carbureter, it must first be rid of its distillate. A large Los Angeles market company uses straight distillate with an auxiliary tank for gas. When the cars are sent from the store to the garage at night, they are run the last mile or so on gasoline from the auxiliary tank. This leaves gasoline in the carbureter and gas vapor in the cylinders so that the car starts on gas and runs on it long enough to warm up the engine for the distillate vapor.

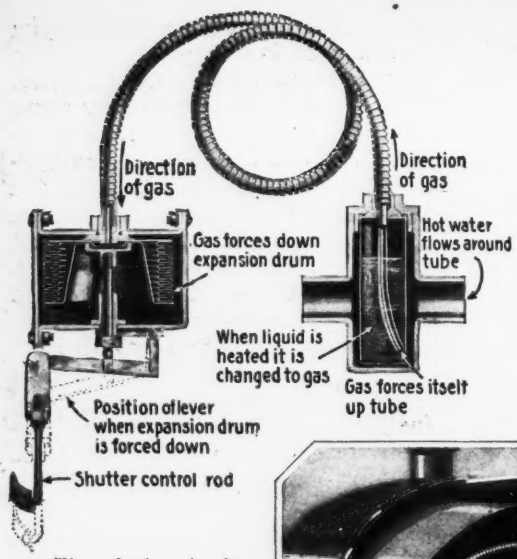
A new experimental device for burning either distillate or kerosene consists of a double-compartment steel tank of small size located about the place usually occupied by the old carbureter, one compartment containing gasoline, the other distillate or kerosene. One is piped to the main tank holding distillate or kerosene, the other to a smaller tank under the seat for the gas. Two rods lead to the dash, and control the outlet valves of the two compartments. A coil of copper pipe runs from the main outlet pipe going to both valves into the exhaust manifold and then up into the main carbureter.

The fuel, whether gas, kerosene or distillate, stands up in this coil, which becomes very hot from the exhaust gases. The driver turns one lever on the dash, admitting fuel from the gas side of the two-compartment tank into the coil, and starting the engine on the gas. Then he closes that lever and opens the other, allowing the distillate or kerosene to rise into the heating coil. The practically vaporized fuel is then sucked into the carbureter and sent very hot, to the engine.

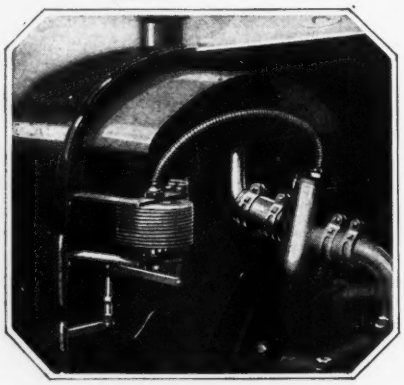
"To the Victors Belong the Spoils"—If They Dare Take Them

MR. A. K. YAPP, secretary in charge of the Y. M. C. A. work on the Western front, in a recent interview said: "The spirit of the men is marvelous. We feel we are able to do a great deal to help them during their leisure by providing little luxuries that mean much to the men." One of these luxuries in one of the camps was a piano taken from the Germans. Concealed in the piano was a bomb with the fuse attached to one of the piano strings so that when a certain note was struck, explosion of the bomb would follow.

The bomb-loaded German piano taken as booty. Fortunately the bomb was discovered in time


Direction of gas
Direction of gas
Gas forces down expansion drum
Hot water flows around tube
When liquid is heated it is changed to gas
Gas forces itself up tube
Position of lever when expansion drum is forced down
Shutter control rod

The device is in two parts—an expansion drum which moves a shaft and bell-crank lever to operate the shutters, and a syphon thermostat in the return water line to the radiator tank



Keeping the Engine Temperature at the Right Point Automatically

AN AUTOMOBILE manufacturer is offering a model with automatically-controlled radiator shutters. His device combines two well-known automobile devices, the radiator shutter and the thermostatic control for the temperature of the engine water.

The combination of the two devices has made it necessary to make the apparatus in two parts—an expansion drum which moves a shaft and a bell-crank lever to operate the shutters, and a syphon thermostat in the return water line to the radiator top tank. The two parts are joined by means of a short flexible hose which ends in a small metal tube at the end of a pot in the return water line. This tube is filled with a sensitive liquid which changes into a gas when the temperature of the cooling water passing around the tube in the iron pot in the water line reaches 140 degrees Fahrenheit. The expansion of the gas creates a pressure in the tube and the flexible pipe connecting it with the expansion chamber, so that the latter is moved downward. This motion, by means of the system of rods and levers shown, opens the shutters slightly and admits air to the motor. This opening action has a maximum temperature point of 180 degrees with a full opening of the shutters. Should the temperature of the cooling water change, the shutters are opened or closed, as the case may be, to maintain an even engine temperature.

How the French Prepare Dummy Airplane Fleets for Target Practice

WE take off our hats to the Frenchman who conceived the idea illustrated below. For simplicity of construction and the efficiency with which it performs its duties, it is in a class all by itself. It is nothing more or less than a fleet of dummy airplanes suspended from a crossbeam attached to a tree to afford target practice for the French air men.

The dummy planes are suspended just as any boy might suspend toy planes, except that strong wire rope is used. The rope is long enough to give plenty of opportunity for the wind to whirl and toss the planes.

French Official Photo

The airplane targets suspended from a crossbeam attached to a tree sway and dart about in the wind

Maybe you have special needs. Write to the editor about anything within the scope of the magazine. He will be glad to help you.

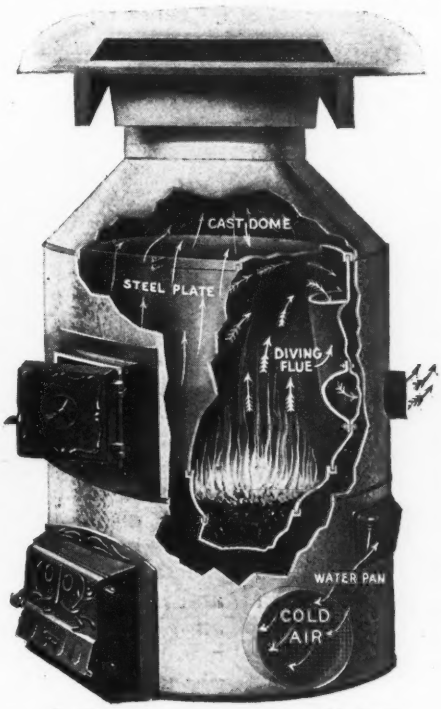
Curing Soldiers' Wounds with Granulated Sugar

DESPITE the terrific fighting in the present war there will not be so many one-armed and one-legged men as there have been in past wars. The reason rests with the surgeons and the methods of treatment given the wounded. Dr. Alexis Carrel has been doing some remarkable work in France. He has made an effective antiseptic from sodium hypochlorite and boric acid. But for real ingenuity credit has to be given to Dr. Erich Meyer, of Germany. He has cured wounds with sugar.

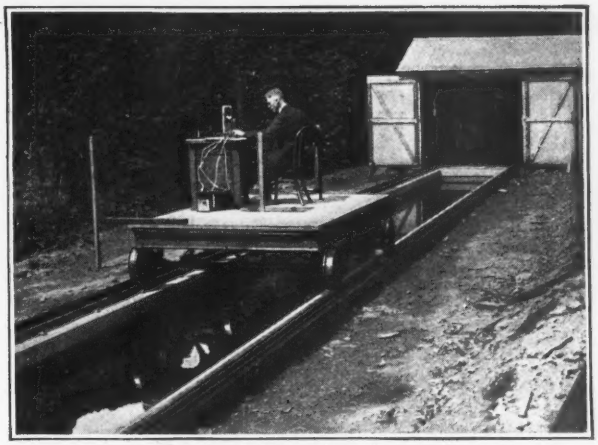
After washing out the wounds he has dressed them with ordinary granulated sugar covered with a compress, renewing the sugar every second or third day. This simple treatment, according to Dr. Meyer, has been notably successful. In a number of instances amputations have been prevented because the wound was sugar-cured.

This New Furnace Burns Soft Coal and Cleans Its Own Radiator

IN view of the coal shortage and the necessity of burning more soft coal than ever before for heating apartments and private houses, a new furnace that has a self-cleaning radiator which does not become clogged with soot is timely. By means of a diving flue the soot is deposited in the fire chamber before it has a chance to enter and stop up the flues. The radiator may also be used for burning hard coal, coke, or wood. The furnace is so constructed that it may be used for either a single register or pipeless furnace, or with the radiating pipes. It has the up-to-date appliances for humidifying the air and securing cleanliness and ventilation.



Construction of the new self-cleaning furnace. It may be used with single-register or radiating pipes



A type of car used for calibrating water current meters for measuring the velocity of running streams

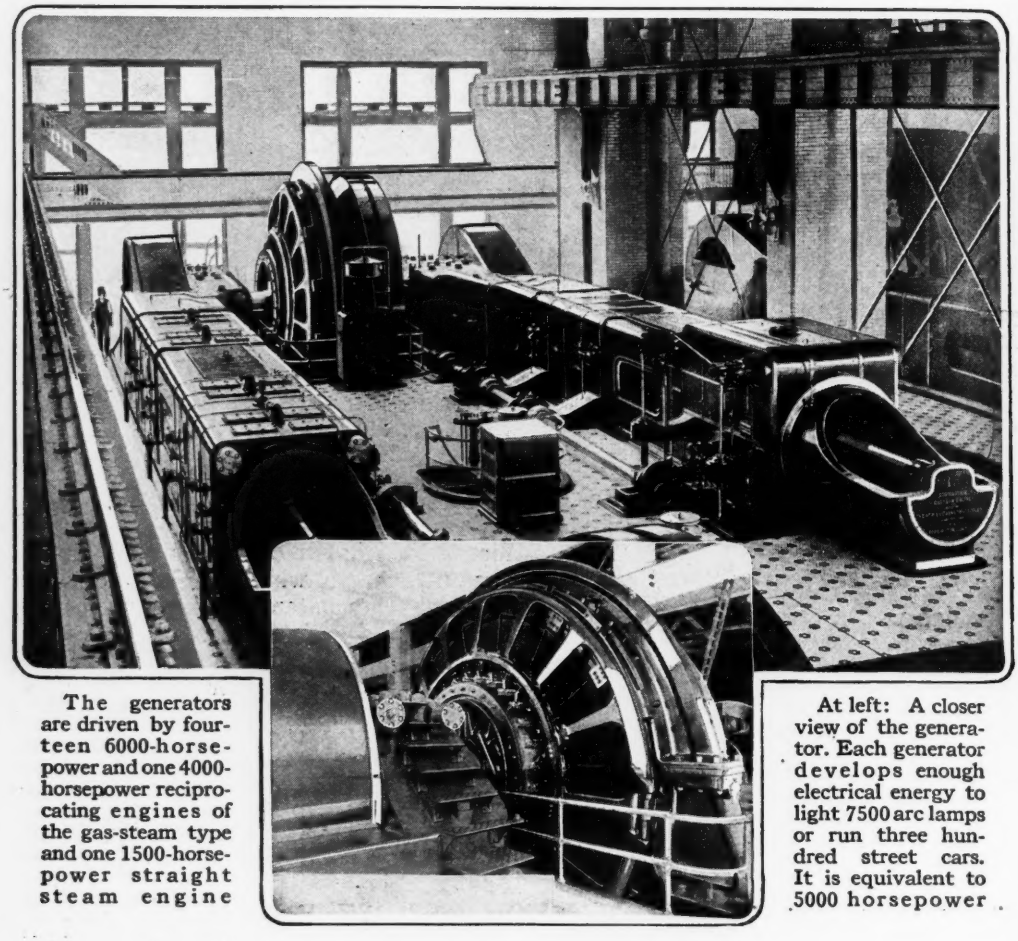
Calibrating Water Current Meters Which Measure the Flow of Rivers

THE little railroad shown in the photograph above is not for the purpose of joy-rides for school-boys, as a youngster might think at first glance. It is a conveyor for an instrument of large name and important purpose, which is used to calibrate water current meters, instruments used by civil and hydraulic engineers for measuring the velocity of the water flowing in rivers and open channels. These velocity measurements, in connection with the cross-sectional area of the stream at the point where the velocity measurements are taken, are used for computing the quantity of water being discharged by the stream in a given time. Such statistics are necessary in many engineering projects, such as water power development, irrigation and flood prevention.

Hundreds of such calibrations are made annually by the United States Geological Survey, the United States Reclamation Service and other branches of the Government.

The Largest Direct-Current Power Plant

Each generator is in four parts and each of the four parts required an entire freight car in transportation



The generators are driven by fourteen 6000-horsepower and one 4000-horsepower reciprocating engines of the gas-steam type and one 1500-horsepower straight steam engine

At left: A closer view of the generator. Each generator develops enough electrical energy to light 7500 arc lamps or run three hundred street cars. It is equivalent to 5000 horsepower

THE installation of the largest direct-current generators ever built in this or any other country is now rapidly nearing completion at the Detroit works of the Ford Motor Company. This power plant has a maximum rating of 65,000 kilowatts or approximately 87,000 horsepower and is the largest strictly direct-current system in existence.

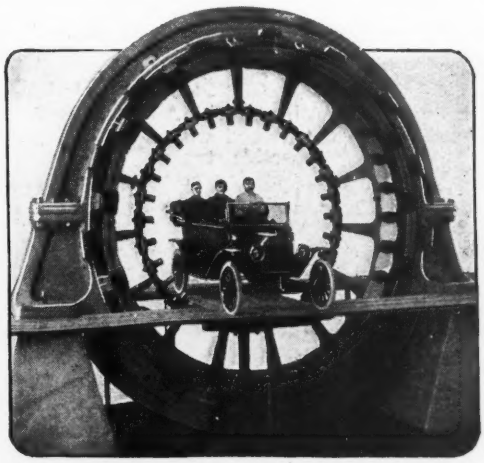
This immense amount of power is used to run the motors which operate the more than eight thousand machines distributed over the forty-seven and one-half acres of floor space in the Ford factory. In addition, these generators supply current for the motors of the ventilating system and the lighting circuits of the plant.

The switchboard which controls this electrical system is 424 feet long and consists of 222 dark Tennessee marble panels. It was built at a cost of $400,000 or nearly $1,000 per running foot. The amount of copper used in its construction for bus-bars, switches, etc., was approximately 165 tons and at current prices would be worth nearly $100,000 in the raw state.

In order to give unity to the whole system and insure continuous service at all times, an elaborate signaling system has been installed. This consists of a 200-pair telephone switchboard which connects with engine-operating stands, boiler rooms and every distribution center throughout the factory. In the office, in connection with

this switchboard, is a panel carrying 300 signal lamps and a duplicate set of telephone terminals. When a feeder is in operation a green lamp shows. This is replaced by a red lamp when the feeder is not in operation. This makes the location of any trouble in the system an easy matter.

The field frame of these gigantic generators is twenty-one feet high and twenty-six feet across the supporting legs. The weight of each complete generator is 105 tons. Five tons of copper are used in its construction. Owing to their immense size, it was necessary to construct these generators in parts, for the height of the armature alone is greater than the clearance on most railroads at bridges and tunnels. To transport the parts of each generator from Ampere, N. J., to Detroit, Mich., required four freight cars.



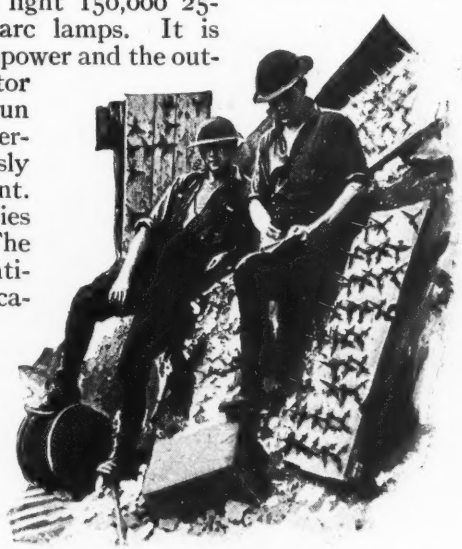
Here you get an idea of the size of the generator by a simple comparison of the field casting with a four-passenger Ford car

Each generator develops 3,750 kilowatts at an electrical pressure of 250 volts and 80 revolutions per minute. This quantity of electrical energy would light 150,000 25-watt lamps, or 7,500 arc lamps. It is equivalent to 5,000 horsepower and the output of a single generator would be sufficient to run 300 street cars. Each generator supplies continuously 15,000 amperes of current. The whole plant supplies 260,000 amperes. The total output is one-eightieth of the potential capacity of Niagara.

These generators are driven by fourteen 6000-horsepower and one 4000-horsepower reciprocating engines of the gas-steam type and one 1500 horsepower straight steam engine, all of which are direct-connected to the shafts of the generators. The water used in cooling cylinders, pistons, valve boxes and bearings of the gas unit leaves the engine at a temperature of 175 degrees Fahrenheit and is utilized for boiler feed and hot water factory supply. The exhaust gases, at a temperature of 1100 degrees Fahrenheit are employed to maintain the temperature of the steam between the high and low pressure cylinders of the steam engines, after which it preheats the boiler feed water. The steam engines are of the double expansion Corliss type. The boilers contain 1800 tubes having an approximate heating surface of 26,000 square feet.

One of the Ways the Retreating German Army Tried to Prevent Pursuit

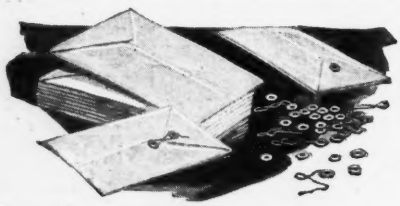
WHEN the Germans made what has become known as the strategic retreat of the Hindenburg Line they very naturally wanted to prevent the Allies from following them too closely. Various obstacles were put in the path of the pursuers. Those which they counted on to make the most trouble for their enemies were huge spiked boards, shown in the accompanying illustration.



Germany's spike-studded boards which were left all along the roads when the Hindenburg Line retreated. They were intended to cripple the pursuing Allies but they were discovered in time

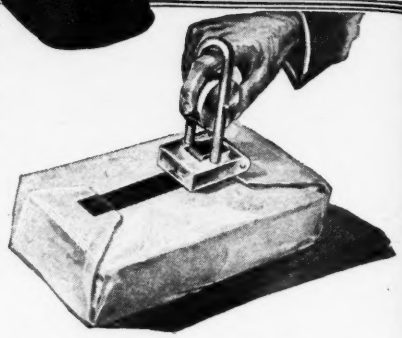
These wicked-looking boards were placed all along the roads and in the trenches. They are constructed of heavy planks thickly studded with spikes. These were covered over with brush, leaves, branches of trees or any other available "camouflaging" device which might be depended upon to conceal the obstruction from the rapidly advancing troops.

Efficiency Hints and Little Helps for Your Office, Sir



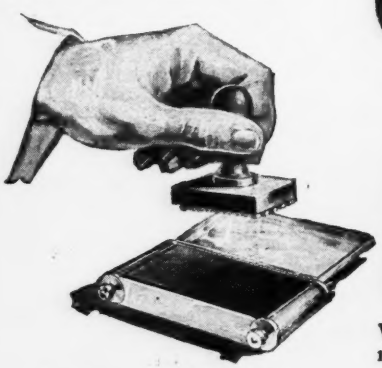
Above: A standard with separable trays for sorting and filing mail

Gummed washers as tie fasteners to be attached to an envelope or package containing other than first class mail matter



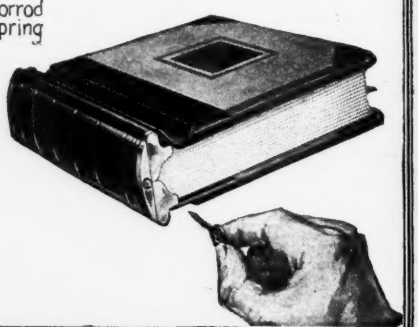
Adhesive tape container with moistener for binding packages

With this container mucilage may be applied and spread without getting the fingers sticky

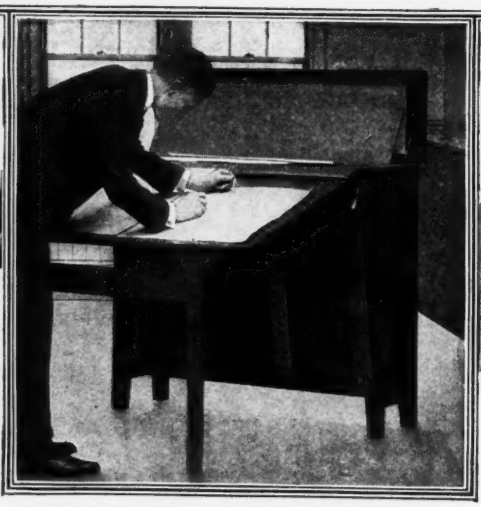


A stamp pad with an inking ribbon roll similar to a typewriter ribbon

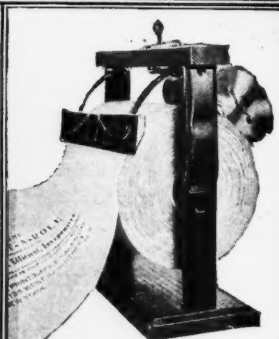
Below: A pin tumbler lock for loose leaf binders



A card-index holder having the names and addresses of customers in plain sight and the notation covered over by the overlapping index sheet

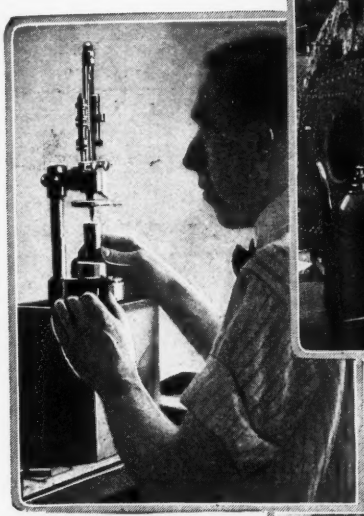


Blue print file and desk with drawing-board attachment for copying notes and measurements coveniently



A printing attachment for paper roll holders. It prints advertisement on each strip of the paper torn off to wrap a package

Do It With Tools and Machinery



With an oxy-acetylene blow-pipe five hundred stay bolts were cut in fifty-eight minutes, a record time for such work

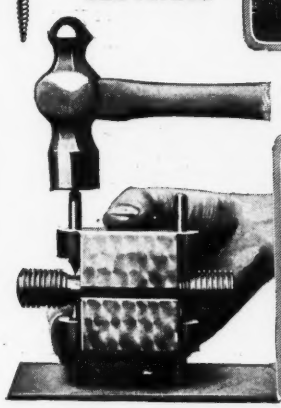
Testing cartridge plug-gage heads to close limits, by the use of a fluid gage

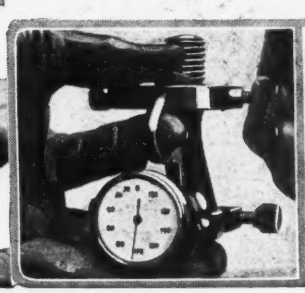
This holder for chisels and plane irons keeps the edge at the proper angle

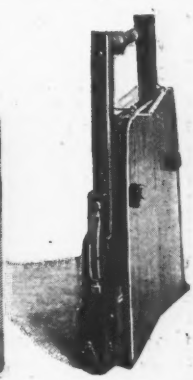
A holder to be attached to a screw-driver so that a screw may be held and turned

A tap or spout for puncturing a can cover. When attached to the can by a thumb nut, it delivers the contents in driblets

A paint gun for applying liquid coatings. It works on the principle of an air brush





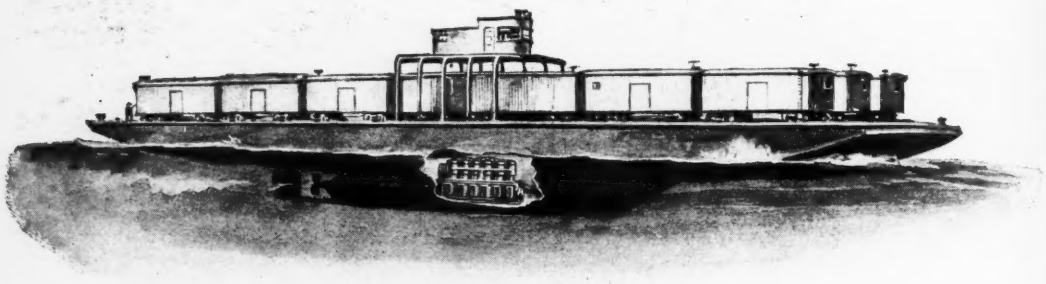


An instrument that shows the elasticity of a bar. Method of placing it on the bar

Wheelbarrow that folds completely up so that it occupies little storage space

An Engine-Carrying Fin for the Power-Boat

A device for conserving floor space on the boat and for enabling the boat to turn in its own length



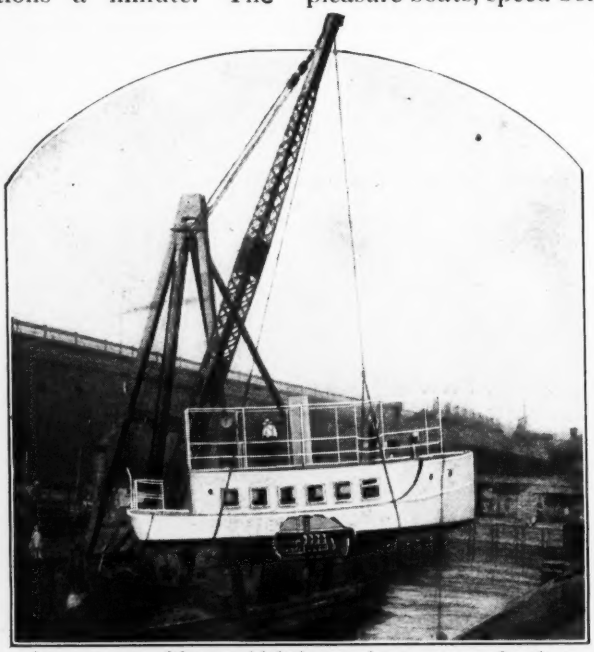
The engine-containing fin principle applied to car floats. These large, clumsy floats can be handled as easily as a light motor-boat, and the need of a tug is thus done away with

ALL the captains who sail the briny deep are not satisfied with their ships. Captain Samuel Golden was not so pleased with ships as he found them that he did not think they could be improved. Therefore, he thought out methods of improving power-boats. So far the captain has built three boats, all designed along the same lines.

The last one, known as the "Shib 11" is a forty-foot houseboat equipped with a four-cylinder 28-hp. engine which operates at about 500 revolutions a minute. The peculiarity of the construction lies in the fact that the boat is equipped with a fin which is about twenty feet in length, twenty-seven inches in width at its widest part and twenty-six inches deep. The engine is built in this fin. The propeller is an ordinary three-bladed side propeller, twenty-two by thirty-inch pitch. The rudder is smaller than those used in other boats of her size.

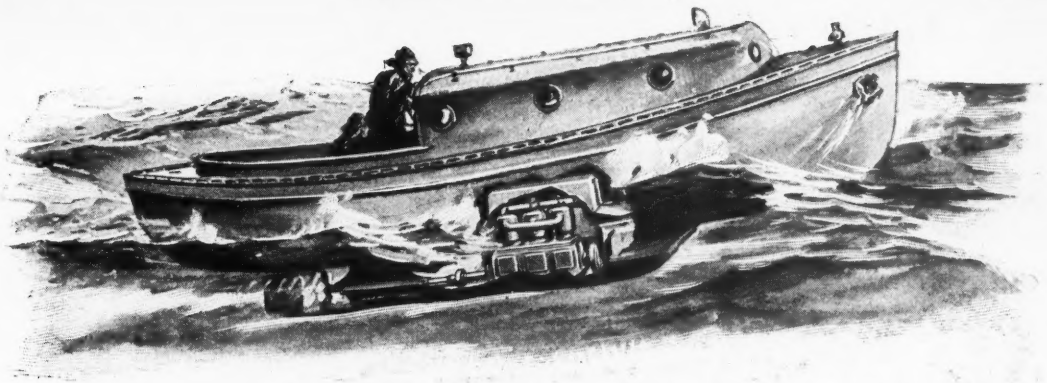
The entire fin is submerged. The water flows around the extreme lines of the fin without any suction. Therefore, the full surface propeller blades are available for pulling as well as thrusting. The thrust from the propeller cannot rise into the air. No air can reach the wheel.

The short narrow fin and the position of the rudder and propeller make it possible to steer the boat with great accuracy. One advantage in this construction lies in the fact that this type of boat may be used for many purposes, such as for tugs, lighters, pleasure boats, speed boats, ferry boats and power life-saving boats. In crowded harbors it is very necessary to be able to handle ships without mishap. The invention of Captain Golden makes it possible to turn any vessel in its own length and makes steering far more accurate than it is with ordinary boats.



A new type of boat which has a short narrow fin that contains the engine. The propeller is always under water. This boat may be steered with great precision

The size of the fin is in proportion to the size of the boat. In the case of a float for railroad cars the fin is large enough to be a good-sized engine room. A



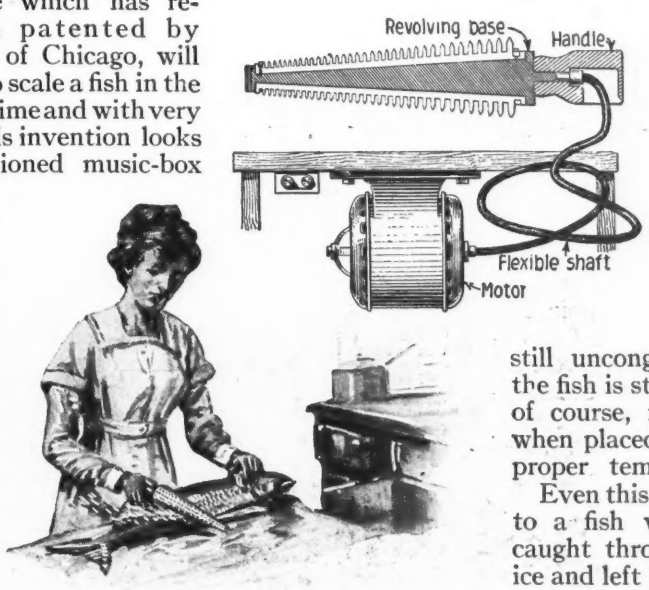
A power-boat equipped with a short fin. The position and construction of the fin make it possible to turn this boat around in its own length. This is an important feature in a crowded harbor

two-hundred-and-fifty-foot float would have a fin twelve feet in width. The engine would take up four feet, which would leave four feet on each side for passageway. On such a large boat a great part of the engine would be above the fin and there would be plenty of room to get at any part of the mechanism.

Small boats, like motor-boats, have a narrow fin and a correspondingly small engine. All that is necessary in such boats, is arm space around the engine. A man can reach any part of the engine from the floor above it.

Zip! Zip! The Electric Fish Scaler Is Cleaning the Fish

A NEW device which has recently been patented by Louis Weinberg, of Chicago, will enable anybody to scale a fish in the shortest possible time and with very little effort. This invention looks like an old-fashioned music-box cylinder, except that the teeth are mounted on a tapered body. The scraper blades or teeth are larger and farther apart on the thick part of the body and finer and nearer together where it tapers. The coarse blades are to be used on large fishes having heavy scales.



Turn on the current and scale your fish electrically. A flexible shaft runs from an electric motor to the tapering scraper

Can a Fish Frozen in the Ice Be Restored to Life?

OCCASIONALLY a "fish" story gets into circulation which has such a scientific flavor that it challenges the credulity of even the very well informed. To this class belongs the story of the resurrection of a fish called the "Chindagaks," which, it is reported, will come to life again after having lain frozen solid in the ice for months.

According to the authorities connected with the United States Fish Commission, the Chindagaks is a newcomer not only into the field of fish literature but also into the lists of known species. None of the experts on the Commission has heard of it before. They declare that when a fish is entirely frozen, life is extinct; though it is possible for a fish to appear to be frozen when its flesh is only stiffened from the cold. The blood is still uncongealed, therefore the fish is still alive and will, of course, revive gradually when placed in water of the proper temperature.

Even this will happen only to a fish which has been caught through a hole in the ice and left lying exposed on the ice surface until it has become stiffened from the cold.

© Int. Film Serv.

This building was constructed entirely of corn. The color effects were obtained by using white, purple, yellow and red corn, many thousands of bushels being consumed in the making

Residents of This Western Town Are Not Worrying Over Corn Shortage

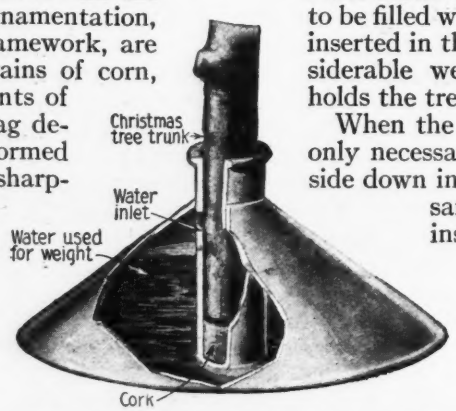
JUBILANT over the bumper crops which have surpassed all previous records, the residents of Mitchell, South Dakota, have given vent to their enthusiasm by building an enormous palace in which all the intricate designs in the ornamentation, as well as the entire framework, are worked out either in grains of corn, cobs or stalks. The points of stars in the American flag designs are ingeniously formed from quarter-sections of sharp-pointed ears of corn.

Thousands of bushels of corn were consumed in making the palace. We are wondering if the enthusiastic corn-growers have heard the food conservation appeal recently made to the nation.

A New Christmas-Tree Stand That Prevents the Tree from Tipping

A NEW type of Christmas-tree stand is like a giant bottle with a broad base, into the neck of which the tree fits snugly. The bottle, or shell of the stand, is made of sheet metal or galvanized iron, and is to be filled with sand before the tree is inserted in the neck. This gives considerable weight to the stand and holds the tree steady.

When the tree is taken down, it is only necessary to turn the stand upside down in order to empty it of the sand. Water may be used instead of sand, if desired. The use of water will make the stand equally weighty and will serve to keep the tree fresh and green much longer. It is so simple that a child can adjust it.

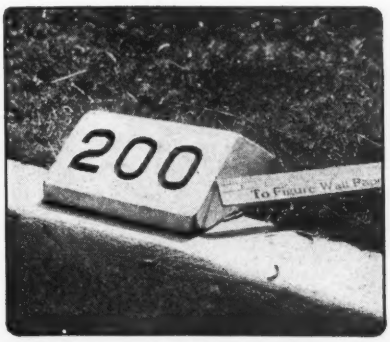


This bottle-shaped Christmas-tree stand may be weighted with either sand or water

House Numbers in Concrete—You Can See Them from Your Car

THE latest style in house numbers in Pasadena, California, utilizes concrete blocks in which the numbers are molded. These are set out on the edge of the curb so that he who runs (in an automobile) may read without getting out of his car and walking up to the house to find out whether it is the place he is looking for or not.

The blocks are only four by seven inches, face surface, with triangular sides, that slope back from the street. The ruler shown in the picture is placed so as to give an idea of the size of the lettering.



Concrete blocks bearing the house numbers are set on the curb in front of the residences

Setting Broken Bones by a Portable Machine

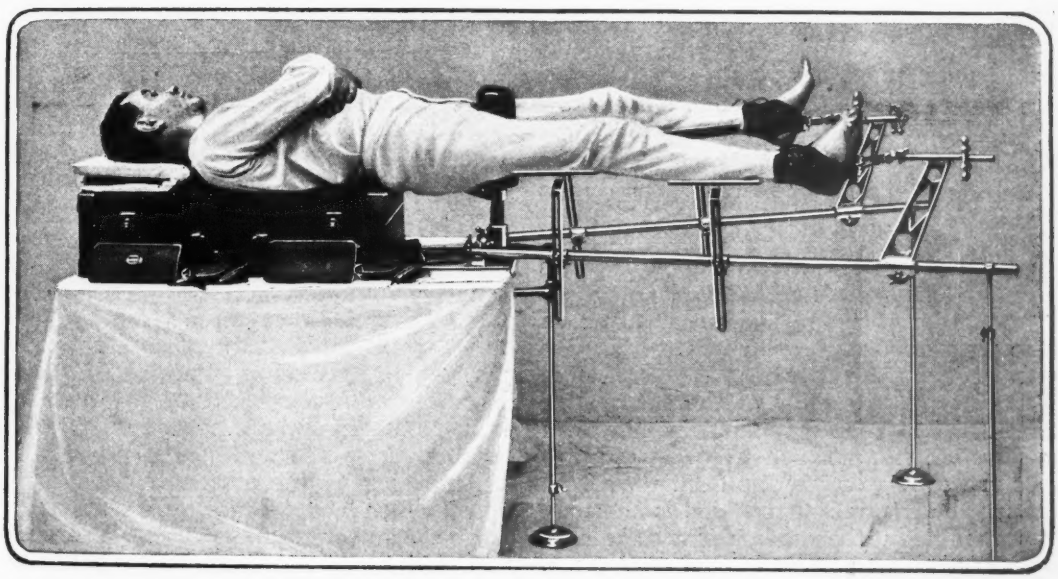
A NEW machine for setting fractures of the legs has been designed and patented by John H. Wilting of Buffalo, N. Y. One of the most interesting features of the apparatus is its light weight, thirty-five pounds. The average fracture-setting apparatus is too heavy to be moved about from place to place. This one may be carried by the physician to the patient.

When the machine is unpacked the case acts as a rest for the body of the patient. Two arms support the legs. These arms are so arranged that the injured member may be set so it will be exactly the same length as the uninjured leg. The measure of the uninjured leg is taken and the injured leg is drawn out to correspond to it.

Movable supports are provided for the limbs. Hence there is no strain on the fractured leg. The supports are made of wood fiber so that X-ray pictures may be taken of the leg while it is resting on the supports. A plaster cast may be put on the fractured leg while the patient is on the machine.

When the machine is packed up it fits compactly in the case. This apparatus should be very useful for army purposes because it is so easy to move it about.

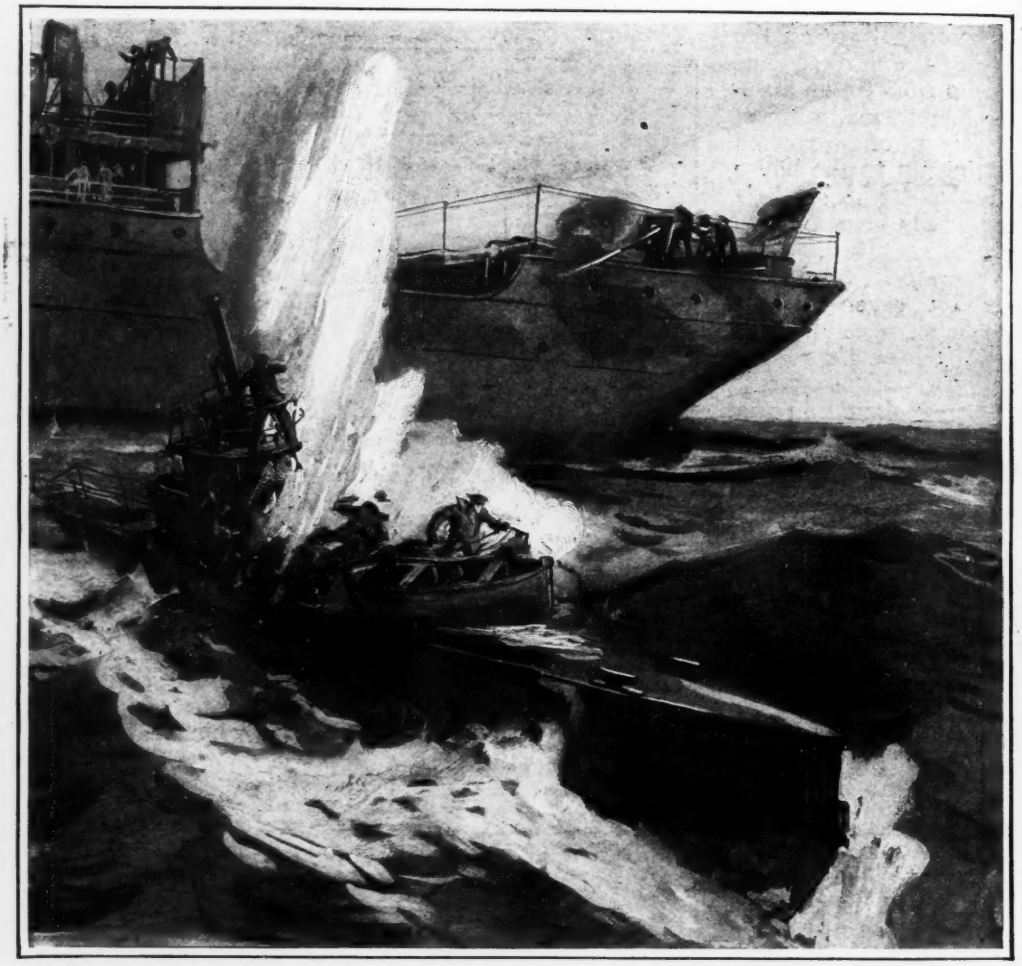
The case is the size of an ordinary suitcase, and is made of black walnut, with a dust-proof cover. The large amount of aluminum and fiber which enters into the construction of the apparatus explains its extreme lightness.



A fracture-setting device which may be operated anywhere. The entire apparatus may be packed up in the case on which the patient's shoulders are resting, and it weighs only thirty-five pounds

A New Sea Camouflage Foils the Submarine

A painted curtain is used to conceal the guns and make the vessel appear unarmed



The U-boat approached to within twenty yards of her intended victim believing her to be unarmed. Then the false curtain was dropped from the after-poop deck, revealing the big stern gun. The submarine was destroyed by the gun's first shot, the whole crew perishing

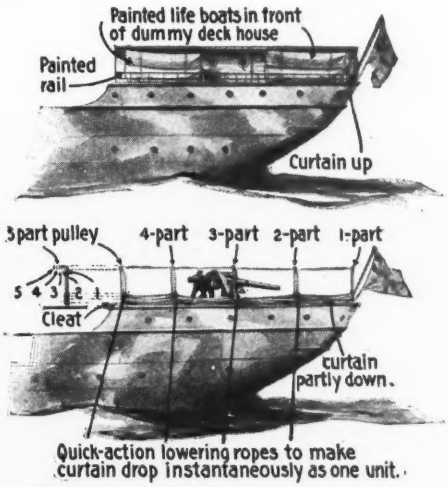
At least one German submarine has already been sunk by the latest adaptation of camouflage to sea warfare in the form of a painted curtain to hide the stern gun of a merchantman. The purpose of this new adaptation of the camouflage idea which is now so commonly employed in connection with armored cars and tanks is to get the submarine to approach the vessel under the impression that she is unarmed and then to put the gun into play so quickly that the U-boat cannot submerge in time to escape being hit.

While this kind of deception has been practiced in different forms, such as the dummy funnels and fake topsides of the German raiders *Emden* and *Moewe* and in the many grotesque futurist daubs of paint with which some of our own vessels are now blessed, this is the first time the ruse has been employed for the benefit of the submarine.

According to the officer of the British vessel which had the encounter referred to, the German submarine was first seen some distance away with her periscope showing. The ship's big gun was hidden behind a collapsible curtain screen which covered the

entire stern and which had been painted to resemble lifeboats.

The curtain was in sections, each with rings slipped over extensions of the rail uprights. It was lowered instantaneously as a unit by means of ropes running over small pulleys at the top of each upright and tied to a cleat on the deck. The submarine approached to within twenty yards of the vessel. Several men clambered up out of the forward hatch with a collapsible lifeboat. The ship's curtain was suddenly dropped; the guns were brought to bear, and fired. The first shot struck the U-boat at the base of the periscope and she sank in four minutes carrying her crew with her.



The top picture shows the camouflage curtain in position, its painted lifeboats plainly visible from a distance. The lower picture shows the curtain lowered and the gun deck cleared for action

Butter? No; Pass the Oleomargarine, If You Please

IN some parts of Germany, according to the Bulletin of the Chicago Section of the American Chemical Society, oleomargarine is quoted at higher prices than butter. "Now how do you account for that?" asked a man as he read it. We have no direct information so we claim the privilege of several guesses. The statement does not record just what kind of butter it is that is cheaper than oleomargarine. Some of us can hark back to student days in Germany and recall little platters of virile, puissant and mighty butter that were placed before the guests at the table (but not the landlady), and the memory of it, through the long and arduous years, carries the sense of economy. Butter like that seems bound to be cheap; by rights it should be cheap; cheaper an anything else one can think of.

But there is another reason which may explain why even good butter may be worth less than oleomargarine. There is a fat famine in the land, and oleomargarine produces a greater number of calories than butter. We are told by those who have traveled in Germany since the war has been raging that the craving for fats, after being on short rations for a while, becomes so intense that the mere sight of butter induces a disposition to throw all propriety to the winds and devour the fat like a beast. Oleomargarine may "go further" than butter in satisfying this intense craving.—ELLWOOD HENDRICK.

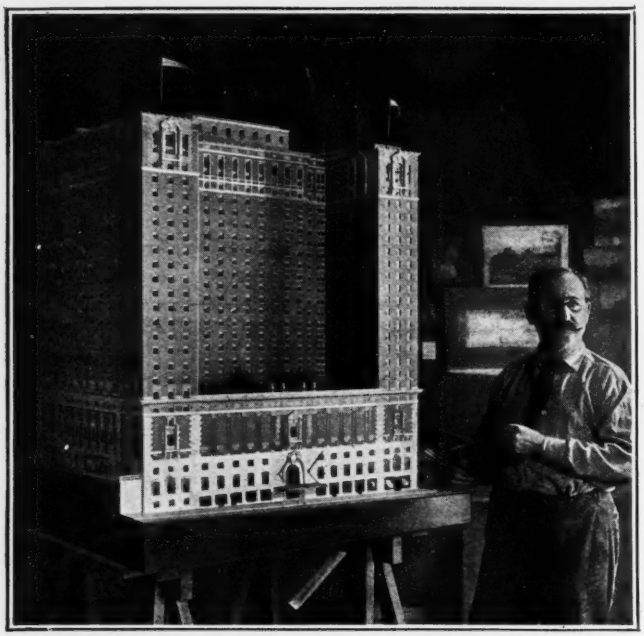
The Up-to-Date Baby Has a Wheeled Dressing Table

A CERTAIN Philadelphia (Pa.) manufacturer is putting out on the market a baby-dresser on wheels, which is nothing more nor less than a stout piece of fabric stretched on a frame and supported on wheels, so that it can be moved from one room to another. It is large enough to hold the baby's toilet articles as well as the baby himself.

The frame is made of steel with rubber tired wheels. It is rigidly locked when in use, but easily folded up and put out of the way when not in use. It occupies a very small space when stored. It is perfectly balanced and cannot be tilted over, nor will it close up before it is locked.

When not in use for baby, it can be used as a tea-serving table.

This is much better than the nurse's lap after his bath, thinks the baby



An exact reproduction, in miniature, of a large hotel now being built in New York. The windows are of real glass

A Miniature Hotel With Two Thousand Rooms

THE picture above shows a remarkable model of a gigantic hotel which is planned for New York City. The model is a faithful representation of the building as it will appear. Every little detail of ornamentation, coloring, lighting effects and general construction has been faithfully portrayed. The result is a little palace that might accommodate a whole community of Peter Pans. The model was constructed from the plans of the architect who designed the great hotel that is to be. The material used was wood pulp stained to imitate perfectly the stone which will be used for the new building. The windows of the miniature are of glass.

The real hotel when finished will be enormous. It will have a ballroom which will accommodate three thousand dancers. There will be two thousand guest rooms in the building and preparations are being made to serve more than a million people during the first year it is open.

A Motion Picture Camera That Stands on One Leg

ARTHUR SELDEN of Rochester, N. Y., intends to employ a single swinging support in place of the stationary tripod of a motion picture camera to facilitate the following of moving objects and a crank attached to the operator's belt to minimize vibration by indirect driving. No provision is made for focusing.

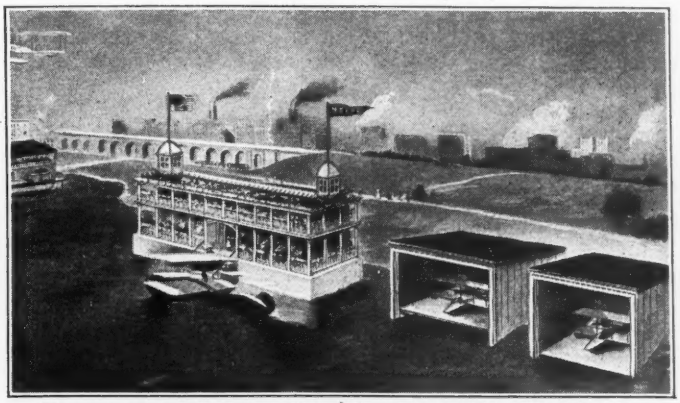
In motion picture work, lenses of universal focus are not employed. An object moving to or from the lens within certain distances will necessitate refocusing. At the same time the crank must be kept in motion without the slightest variation in speed. The photographer using a camera with a single swinging support would find both his hands well employed. Focusing of the lens when the necessity arose would be impossible. It is doubtful, too, whether a smooth, even turn could be made with a crank attached to the flexible body of a man.

Although in this case the inventor has given most of his attention to a more accurate centering of an object in motion, it should be remembered that this feature, with rare exception, is not desirable in motion picture work. An object in motion which is continually photographed in or near the center of the film in spite of its movements will, when projected on the screen, dazzle the eyes of spectators, because the background, which is greater in area, will assume in an opposite direction the identical motion which has been arrested in the object. At best, the majority of such pictures are somewhat confusing and consequently seldom used.

The photographer using a camera with a single swinging support, such as the one shown, would find both his hands well employed

Commuting by Airplane from the Suburbs to New York

IN April, 1916, the New York Flying Yacht Club, the only club of its kind in the country today, wasorganized for the purpose of establishing on the Hudson River a station where aviators and owners of hydroplanes could "house" their machines after making flying trips to Manhattan Island. The day is coming when "commuting" by aircraft will be a common thing. It has been done already by a few wealthy men whose homes are on the water front several miles from New York city. These air travelers will find it necessary to have "garages" for their machines while they sojourn in the city. The hangars will be erected near the club house which will soon be erected at One hundred and Twenty-ninth Street and Riverside Drive on the Hudson.



The proposed club house of the New York Flying Yacht Club and its string of hangars in which the hydroplanes will rest

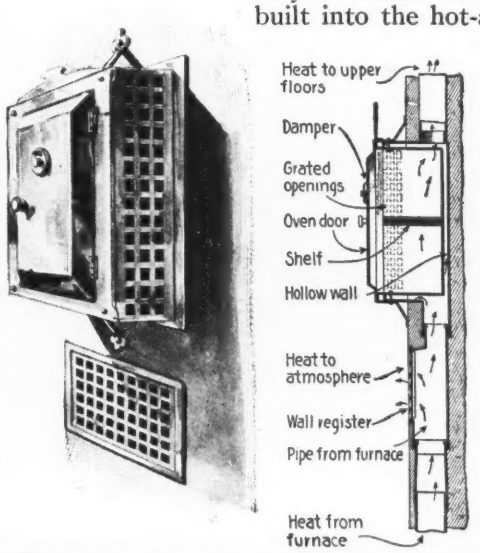
The club building will be two stories in height, with a spacious roof garden. A catering room and a banquet hall will be found on the lower floor. The trophy and club rooms will occupy the second floor. A balcony will surround each floor and the structure will have verandas on all sides where members and visitors can sit and watch the machines in their flight over the land and river.

A gangway will lead from the south side of the structure to the river, and this walk will be used by all persons leaving and boarding their machines. On the roof of the structure will be two observation cupolas which will be used chiefly by officials for timing the races. The roof will also have a powerful searchlight that will be a guide to the aviators who fly in the night. The searchlight will cast a bright perpendicular beam heavenward continually every night and this will be a beacon to the men coming home to roost.

A string of hangars will be built on the water's edge close to the club house. These will be so constructed that an aviator can pull in or take out his flying machine with the greatest ease. The hangars will be big enough to hold the very largest types of hydroplanes.

Using the Heat from the Hot-Air Furnace for Cooking Purposes

IF you have a hot-air furnace you can do your baking by its heat. Here is how it may be done. A sheet-iron oven can be built into the hot-air conduit, as shown in the illustration, and the heated air can be made to flow around the sides and the back of the oven. By this heat the contents of the oven will be thoroughly baked and none of the disagreeable gases in the hot air will be allowed to touch them. Apparently, here is a practical device which can save many a dollar on your coal and gas bills. That at least is what Albert Caro, of Illinois, who is the originator of the idea and inventor of the oven, believes.



The hot air rising from the furnace heats the oven and circulates around the contents

An Imported Jungle in a School Yard

A method de luxe by means of which one set of children could dispense with school books

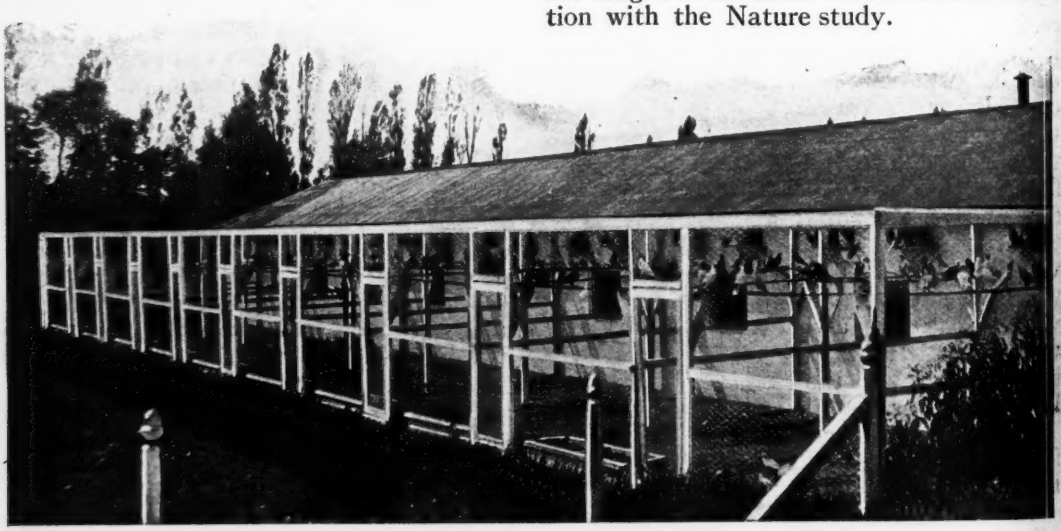
THE children in the family of Mr. George Getz, of Chicago, Ill., are not inclined to neglect their school work. In fact, there is little difference between the school hours and therecreationperiods; for according to the system of education which Mr. Getz has established for them, school work *is* recreation.

On the Getz estate at Lakewood, Michigan, where the children pass the greater part of the year, there is a veritable jungle, full of animals, wild and tame, from which the lessons in zoology may be illustrated at first hand. There are camels on which the youngsters may ride while they learn all there is to know from the Arabian caretakers about the habits of the camels and listen to tales of mystery about the great African desert and Arabian lore more interesting by far than fairy stories. The children know all about the honey bear, the various types of monkeys and other small animals, including guinea pigs and rabbits. All are to be found in their private zoo.

The schoolhouse, built for three children, answers the purpose of a church on Sundays

When the lesson is on birds, there are still finer facilities for study. In the aviary there is almost every kind of bird known to man. These are kept in congenial groups under the care of experienced fanciers. Of course there are all kinds of flowers to supply not only beauty of landscape and material for botany lessons, but also nectar for the bees.

There are vegetables and farm animals of every description, some native to the United States and others from different parts of the globe. Geography and History are taught at the same time and in connection with the Nature study.

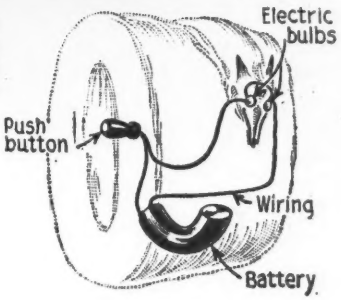


In the aviary almost every kind of bird known to man is kept. History and Geography are taught in story form in connection with the bird and animal lore of the different countries

Illuminated Muffs—They Rob London Fog of Its Terrors

ILLUMINATED wearing apparel heretofore has been designed chiefly for men; now the women may blaze forth in glory.

Take, for example, the muff illustrated here. It is adorned with an animal's head having two eye sockets into each of which a small electric bulb is screwed. A battery nestles comfortably in a pocket in the bottom of the muff. Wires connect eyes to eyes, and eyes to battery. A push button is inserted in the circuit—and the muff is ready for operation.



Above: The muff illuminated. At right: Diagram of the wiring plan

If, on a dark night, our lady drops a coin, loses her way, can't find the keyhole—she need only press the button and lo! there will be plenty of light.

When the fog settles down over London, during these times when the streets remain unlighted at night on account of air raids, the wearer of one of these muffs will not be likely to become confused or disturbed.

The Homemade Ice Sleds of the Chinese Boys

BOYS are boys the world over, and they will find a way to enjoy the ice and snow, whether they know anything about skates or not. In China, skates are a great novelty, and are seen only in cities in which many Europeans live. But when the canals freeze over, the youngsters flock to the ice with the instinct of ducklings for water. They make a kind of sled out of odds and ends of wood—and wood is a luxury in China—and then add to their equipment a long pole having a spike in one end.

Standing on the sled, they push themselves along at a fair rate of speed, and their screams of enjoyment are not less hearty than those of boys in other parts of the world.

Generally speaking, China is a cold country compared with western territories in the same latitude. The winters are much more severe and of longer duration than ours, so that the little Chinese boys get a great deal of enjoyment out of their improvised sleds.

The Chinese boys fashion their sleds out of odds and ends of wood and push them over the glassy surface with spiked poles

Mysterious Sounds That Continually Baffle Science

MYSTERY still attaches to certain explosive sounds, heard in various parts of the world and known to science as "brontides." On the coast of Belgium these sounds seem to come from the sea, and are called locally "mistpoeffers." In the Ganges delta, of India, similar sounds are called "Barisal guns." Brontides are well known in some parts of Italy, where they bear a great variety of names. In Haiti a sound of this character is known as the "gouffre," while in parts of Australia it is called the "desert sound." Brontides mostly take the form of muffled detonations, of indefinite direction. Probably they are of subterranean origin. Studies of eccentricities in the transmission of sound through the atmosphere, lead to the conclusion that some of the sounds hitherto reported as brontides were really due to cannonading or blasting.

Making Flour from Pigskin

A de-hairing machine leaves the skin so free from dirt that the "cracklings" can be used for bread

By Lloyd E. Darling

Coming direct from the scalding tub the hogs are now ready for the final polishing

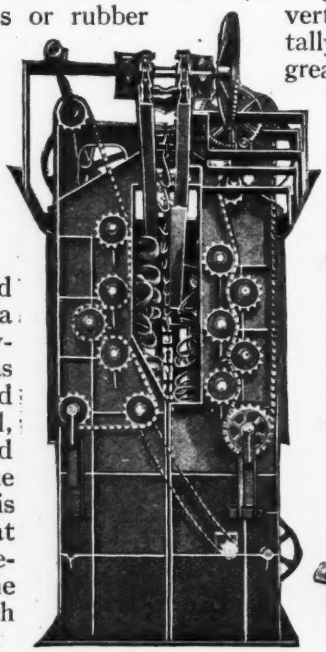
IN Chicago a certain factory makes a business of putting out what are called "hog de-hairing" machines. The function of these devices is to clean up a hog after the slaughter—thereby supplanting an old-fashioned process which made use of knives that scraped hogs razor-fashion. Porkers used to emerge from this latter process looking like an old-time Yankee—that is, reasonably smooth-shaven as to face, but exhibiting a sizable beard under their chins that the mechanically-wielded knives hadn't been able to reach. For the same reason the under side of their legs was left unshaved.

With the newer kind of machine, however, the pigs emerge thoroughly cleaned up—so immaculate in fact that they are referred to in the pork-packing profession as "polished." This is accomplished by thoroughly scalding the hogs in the usual fashion, and then running them through a machine which is nothing more nor less than a battery of "beaters." The beaters are built up of thick canvas or rubber belting bent in the form of loops and studded with angular metal pieces which do the actual work of "polishing" a hog. These loops are attached to steel shafting which is revolved at a rapid rate by means of suitable chains and gearing.

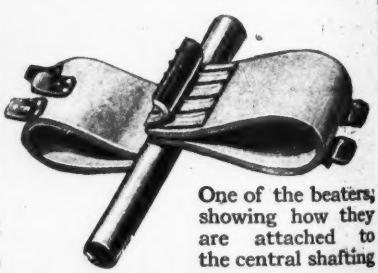
A hog about to be polished is made to run the gauntlet of a whole row of these rapidly-revolving shafts, armored as they are with their steel-studded loops of belting. He is spanked, and batted, and massaged, and rolled over and over by the flying loops. They remove his whole outer skin or "scarf" at the same time that the hair departs. Luckily he is dead or he might seriously object to such treatment. Some of the loops revolve up and down and the others laterally, thus causing the hog in his moving around to be struck from all angles so that every portion of his anatomy is reached. There is no Yankee beard effect left when these machines get through with him. His own mother wouldn't know him, as the saying goes, he is so much changed in color and general state of cleanliness.

The machines are built in a variety of forms, through some of which the hogs go vertically, through others horizontally. The machines work with great rapidity as compared with old knife-scraping forms. Some of them have a capacity of one thoroughly cleaned hog per second.

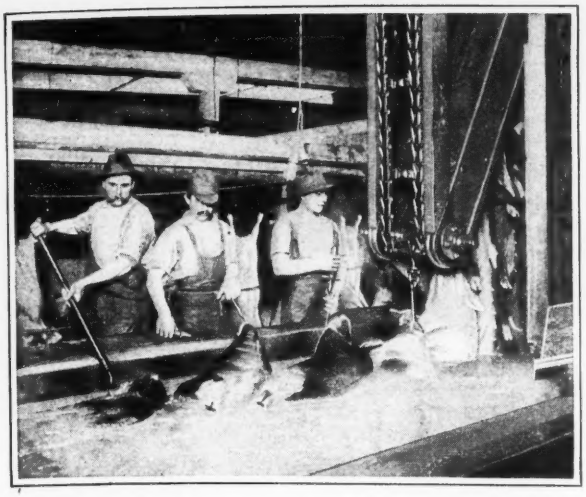
These hog-cleaning machines have been installed now in practically all of the commercial packing plants of the country. The fact that they so thoroughly clean the porkers is far-reaching in its effect, especially from the consumers' point of view.



The de-hairing machine with its battery of "beaters" which polish up the hogs



One of the beaters, showing how they are attached to the central shafting



Drawing the hogs up out of the scalding tub, preparatory to passing them through the machine

As before mentioned, pickled pigs' feet, and snouts, and tails, are much more palatable because of the absolutely clean condition of the epidermis. The brine is not contaminated with hair and dirt left on the skin. Even the ears on the hog are polished inside and out.

It is through this cleanliness obtained by new packing processes that it is now possible to make desirable flour for bread from the skin of hogs.

In every pork-packing plant there is a residue left from the process of trying out lard. It is a mixture of fatty tissues and bits of skin. It is called "cracklings" and is very similar to the residue obtained by housewives when frying out bits of grease. These cracklings from a packing plant come in rather dry form, the various bits having caked together in the process of squeezing out the grease. It is these cakes that the maker of pigskin flour grinds up. The resulting powder is very clean in appearance, and is slightly yellow in color like fine corn-meal. Mixed with a slightly larger portion of ordinary flour, this substance makes very rich bread, without additional "shortening," and is considered decidedly palatable and nutritious.

Pull the trigger of this toy gun and you shoot out—a parachute

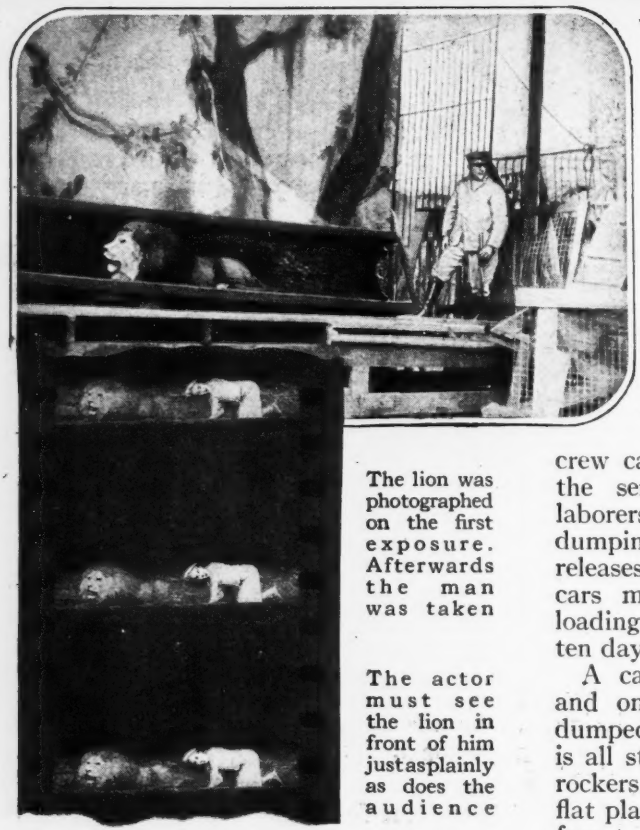
Reclaiming Discarded Metal from Scrap Piles

THE price of metal has risen to such an extent that many concerns are searching their scrap piles in an endeavor to find parts of machinery which may be repaired and put back into use. At one Western mine enough dollies and dies were found in the scrap pile to last three months. They were welded up at a cost of one dollar each. New ones would have cost nine dollars. In the same scrap heap enough short ends of tungsten steel were found and welded together to last a year.

In the scrap pile of a railroad shop a lot of old locomotive drivers were found. These had been discarded because of cracked spokes. The cracks were welded and the wheels are again in use. This reclamation of scrap is made possible by the oxyacetylene process of welding and cutting. Before long, searching the scrap pile will be almost as popular, and perhaps more profitable, than digging for gold.

A Toy Gun for the Pacifists. It Shoots An Umbrella

ONE of the latest additions to the list of harmless weapons for the juvenile warriors is a gun which shoots out from its barrel an unfolded umbrella, or parachute and flag. A strong spring takes the place of powder. The firing mechanism is very similar to that of the ordinary small-caliber revolver. When the gun is ready to be fired the umbrella lies telescoped within the barrel. When the trigger is pulled the hammer is released from its cocked position, striking the firing pin and releasing the catch holding the umbrella. Thus released the umbrella is forced out of the barrel and is unfolded, the ribs which hold the frame out and retain the extended parachute in shape being attached by cords to the gun.



The lion was photographed on the first exposure. Afterwards the man was taken

The actor must see the lion in front of him just as plainly as does the audience

How "the Lion and the Lamb" Lie Down Together in the Motion Pictures

"WHAT chances actors take!" you may exclaim when you examine the photograph above, showing a man and a lion, with a none too pleasant expression, in a hollow log together, each apparently unaware of the presence of the other.

It seems a pity to spoil the effect of such a good thriller by telling the truth about the filming. The lion alone was taken during one exposure of the film. When he had bowed himself out of the log and back into his cage the man was allowed to take the center of the screen, or rather of the log, and was photographed in proper relation to the lion on the second exposure of the same film. But on the screen, of course, they both appear in the log at the same time.

A Labor-Saving Dump Car. It Does Away with Shovels

BOTH speed in unloading and economy of labor are secured with a new dump-car which throws material to either side of the track. The side of the car turns down when dumping and serves as an apron to carry the material clear of the track and cars. In this respect the car differs from any other made, as it discharges the material in such a position that no labor whatsoever is required for shoveling. As the regular train crew can handle the dumping apparatus, the services of section gangs, regular laborers, or extras are not required for dumping. The speed of unloading also releases the rolling stock quickly; for the cars may be immediately returned for loading, instead of being held for about ten days as formerly.

A car is dumped by compressed air, and one car or an entire train can be dumped at one time. The dump car is all steel, and the body is supported on rockers. Equilibrium is provided for by a flat place in the center of each rocker surface. In dumping, the box is merely tipped off this flat surface. When the box is empty the low center of gravity causes it to roll back into place. The car may be dumped to either side by making a slight adjustment. A link fastens the car in the upright position, and a separate lock makes it impossible to dump the contents to the wrong side.

On a single division of an Eastern road the cost of removing waste was reduced by the side dump cars from $100 to $37 a day.

The side dump car in operation. The side piece acts as an apron to carry the waste material clear of the tracks

Barking Wood by Machinery

The logs of wood are made to rub against each other and scrape the bark off automatically

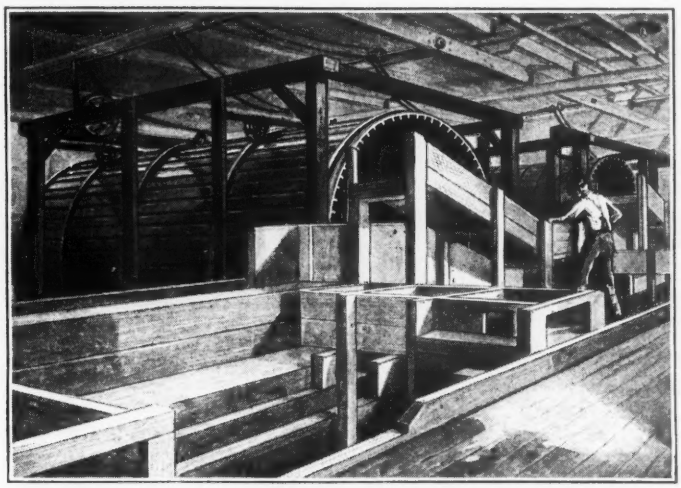
WOOD barking today is not what it used to be—a hand process carried out with long sharp knives. One or two hollow steel drums are all that are now seen in the modern barking mill,—drums that remove the bark from many tree trunks at one time.

Perhaps a dozen huge trees are cut up into a thousand pieces. These are fed into one end of the horizontal, rotating drums. The angle irons, which make up the steel framework, grip the edges of the logs, tumbling them about so that they rub against one another. The bottom of the drum is immersed in a tank of water, so that the bark is soaked and easily peeled off. Fresh logs fed into the drum on conveyors push the barked logs on to discharge-conveyors at the opposite end of the drum.

The construction of this barking drum is as ingenious as is its principle. Since it would not do to immerse the bearings of the drum in the water, the drum is suspended on endless chains which run over pulleys mounted "high and dry" on the top of the barking machine structure.

There is little about the operation that requires attention. In fact, one operator now takes the place of nine skilled whittlers. Altogether, the result in a fair-sized mill which turns out six or seven hundred cords of barked wood in a day, is a saving over the hand method of about three hundred thousand dollars a year.

Strangely enough, though theory would seem to indicate that sharp points mounted radially in the inside of the drum would be more efficient than blunt angle irons, such points are not the choice of experience. While these points would peel off the bark in considerably less time than the irons do, they would also dig into the "flesh" of the wood. The resulting saving in time would be more than offset by the decrease in the commercial value of the wood. For this reason, it has been found best not even to grind down the edges of the angle irons. As a result the wood comes out without a bruise.



The revolving drum which makes a thousand or more logs peel off their own bark. It is operated by one man

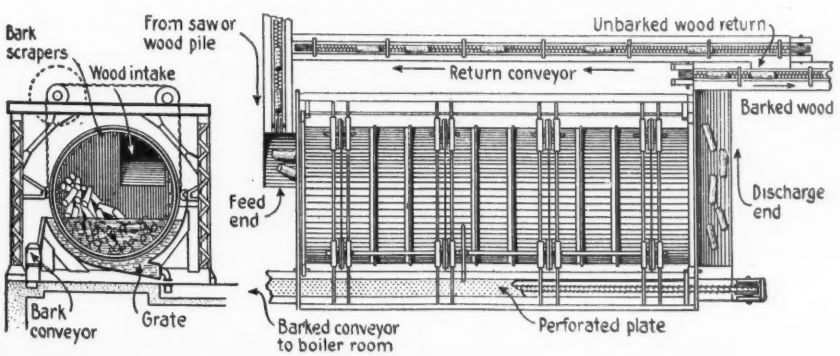


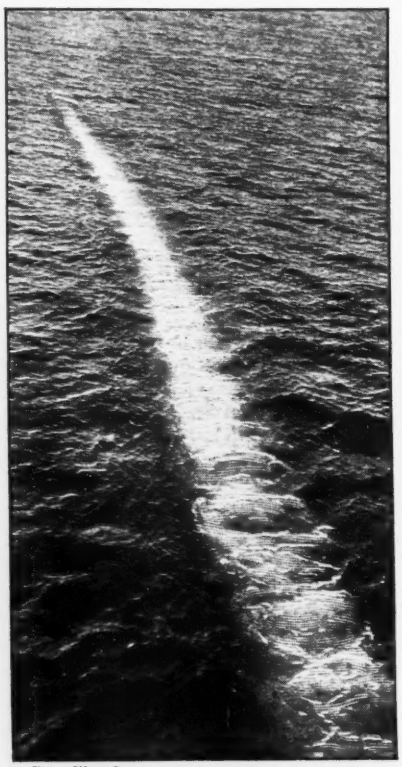
Diagram showing the principle and operation of the wood-barking machine. A dozen huge trees cut up into a thousand or more pieces may be fed into the drum at one time, tumbled about and soaked in water and finally discharged clean

Protecting Battleships with Compressed Air

Should a vessel be torpedoed the inrush of water will be stopped by outrushing air under pressure

UNCLE SAM'S ships have been turned into giant diving bells or caissons to help protect them from torpedo attack. It sounds impossible, but it is not; for it is merely adaptation of the principle of the air lock. This has been used for many years in sinking underwater foundations or driving tunnels under rivers and even in ship salvage work. The hulls of the ships have simply been divided into a large number of compartments to be filled with compressed air.

Should one or more of these compartments or chambers be shattered by the explosion of a torpedo or mine, the adjacent compartments are filled with compressed air until the pressure of the air counterbalances that of the water in the damaged section. When this occurs, no more water can flow into the vessel and she may be towed into port or proceed under her own steam if her engines have not been damaged.



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The wake of the torpedo. It is the only warning which the threatened vessel usually has

Almost the same conditions hold true in ordinary household work when an empty tumbler is plunged bottom upward into a dish-pan of water. The water enters just so far, until the air trapped in the glass is compressed to a point where its pressure equals that of the water. Then no more will enter.

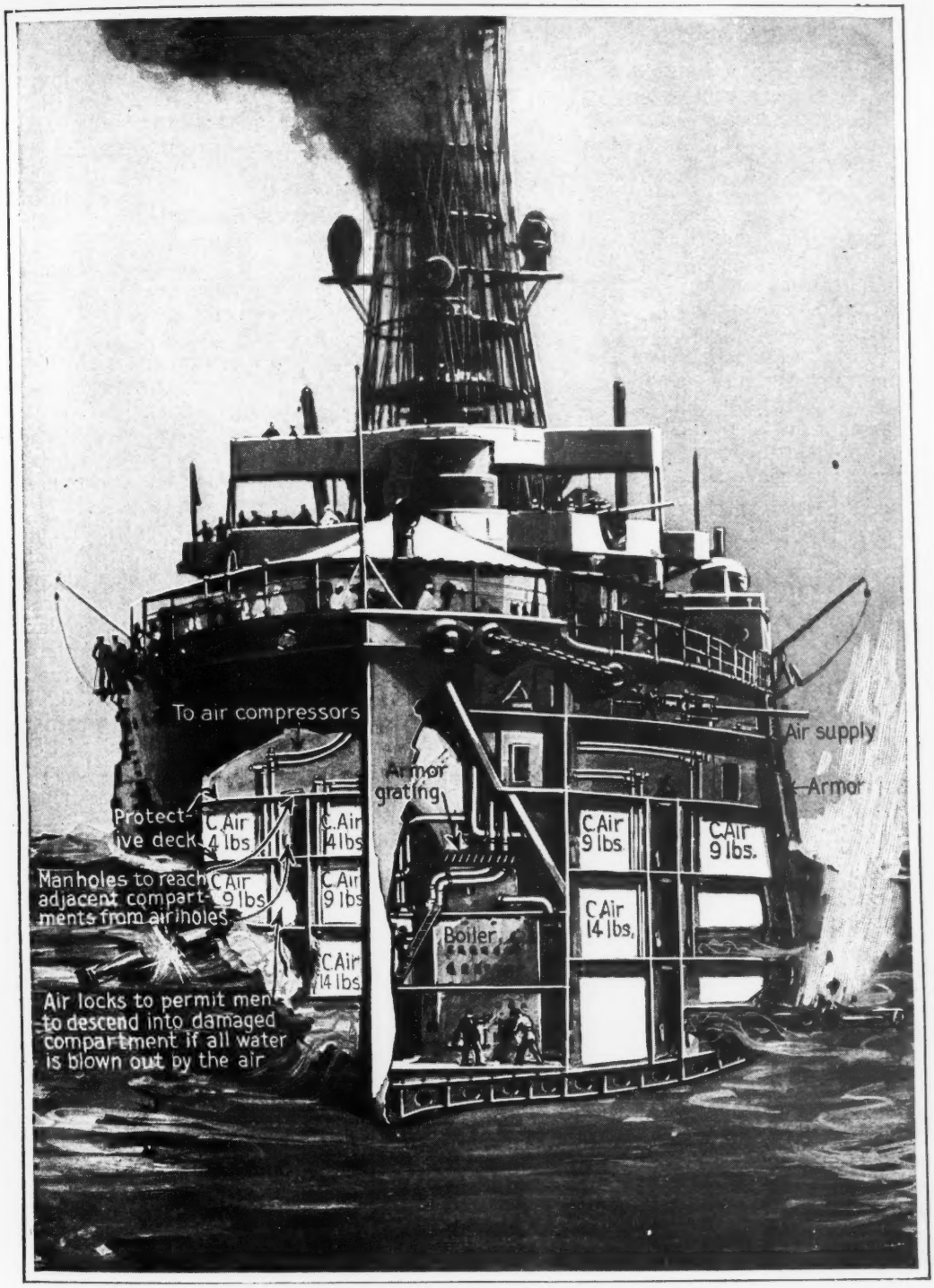
As shown in the accompanying illustration, the hull of the ship is divided into a great number of compartments. Should one of these be punctured by any means, the ones next it are immediately filled with compressed air until the water pressure is equalized and no more can flow in. The compressed air may or may not come into contact with the water in the damaged compartment, according to whether one or more than one chamber is punctured. In any event the pressure of the air in the nearest surrounding intact compartments acts equally in all directions and is liable to make the bulkheads and decks leak. For this reason air at a lower pressure is pumped into the adjacent compartments, the pressure diminishing as the distance of the chambers from the damaged area increases. In this manner, the difference in the pressures in the adjoining compartments is only a few pounds and the bulkheads and decks are well able to withstand it without leaking.

The use of this system has occasioned very little change in the design of the vessels, for battleships always have been divided into many cellular divisions for restraining the inflow of water through damage by collision. Again, means for pumping the compressed air into the compartments was already in place in the form of pipes to pump fresh air into and exhaust foul air from the chambers.

Compressed air is also a common commodity on battleships, being used to run the refrigerating machines, to fire torpedoes as well as charge them and to remove the hot gases from the gun barrels after firing. It was therefore only necessary to provide suitable means for connecting the compressed air supply with the compartment pipes. This did not of course change the design of the inner hull or appreciably increase its weight.

The system, the invention of William Wallace Wotherspoon, a New York City engineer, was first installed on the armored cruiser *North Carolina*. All of our recent battleships have the system, so that our sailors crossing the seas or working in the war zone have a chance against torpedoes.

The Air-Lock Principle Applied to the Battleship



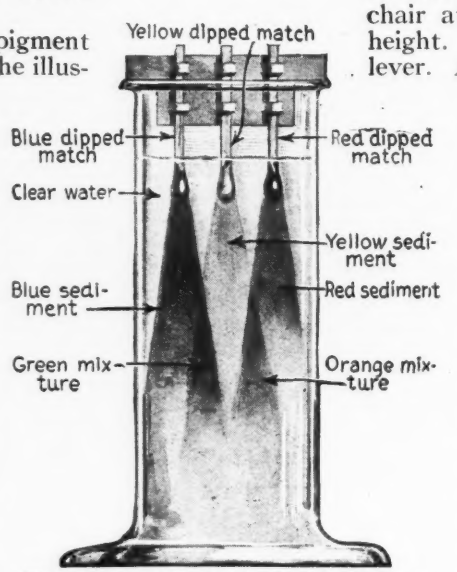
Foiling the Torpedo with an Armor of Air

The broken-away section at the left shows how the compartments in the way of the boiler-room would be filled with compressed air were the vessel hit amidships. Similarly, the section at the right shows how the compartments would be filled if the boat were hit near the bow. At the left it is noticed that the intact compartment nearest the damaged area is filled with compressed air at a pressure of fourteen pounds to the square inch. Adjacent compartments are filled with air at the lesser pressures of nine and four pounds, according to the distance from the punctured section. A ship thus injured could proceed to port under its own steam. The air locks permit men to descend into the injured compartment to make temporary repairs.

A Novel Color Mixer for Teaching Blending Effects

A VERY simple and novel device for illustrating the various color effects produced by mixing different paint pigments can be made in the following way:

Prepare a series of pigment "matches," as shown in the illustration. This can be done by obtaining the soluble pigments in different colors and making each into a thick paste by mixing with a little glue. Dip the end of a match stick into the pigment and when the adhering mixture dries, mount it on a cardboard with one or two other similarly prepared "matches." When these are immersed in a cylinder of water, the pigments at once dissolve, and as they intermingle, the true color effects of the mixed pigments are at once apparent. This is by far the best method yet employed for teaching color effects to a class of pupils.



Pigment "matches" dissolved in water to show the effects of blending different colors

Employing Deadly Gases Against the Sleeping Sickness Fly

IN British East Africa great annoyance has been caused by the tsetse-flies, a species closely allied to the ordinary house-fly, but which in that locality is considered particularly dangerous to health. In New Langenburg, a district recently acquired from the Germans, it has been impossible to maintain horses, cows or cattle of any description on account of the mortality caused by the diseases which the flies are said to carry.

The extermination of the flies has therefore become a matter for Governmental consideration. The latest suggestion awaiting experiment is the use of gases, poisonous to the flies. These, it is believed, could be carried across the fly-infested areas by the monsoons, in the same manner as the destructive gases are carried in trench warfare.

Shoe-Shining by Electricity in a Self-Elevating Chair

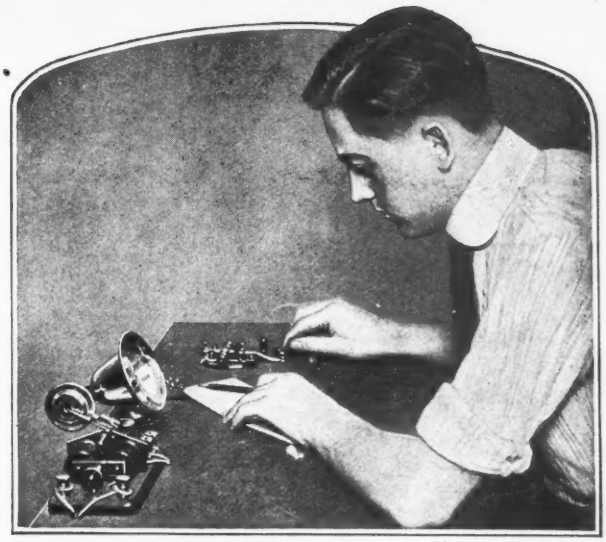
A NEW shoe-shining machine, invented by Otis R. Hasty, of Elgin, Ill., is a combination of an ordinary chair and an electric elevator. You mount the chair at practically the normal height. The bootblack throws a lever. An electric motor drives some gearing which raises a rack-pinion constituting the supporting column of the chair. The foot rest is rigidly connected with this column, so that it rises at the same time.

After rubbing on the paste, the bootblack plugs a short flexible cable to a shaft jutting out at the bottom of the machine. The shaft which is geared to the motor also, imparts its rotation to the flexible cable and to the circular buffer at the end of the cable. The buffer speeds around and brushes your shoes in a twinkling. Such little time is required for the operation that one bootblack can attend to two patrons at a time, polishing the shoes of the first while the paste on the second pair is "setting."

You don't have to be an athlete to climb into this chair. An electric motor raises you to the proper height

German Trenches as Comfortable as Houses

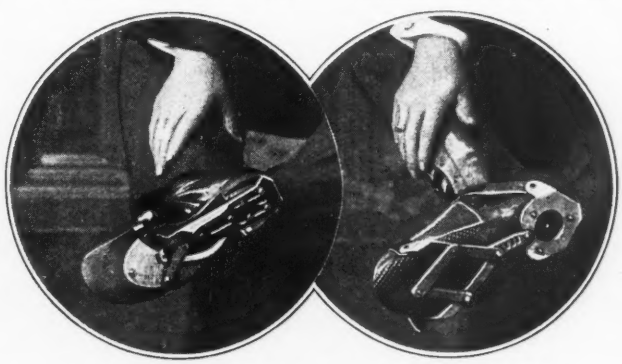
GERMAN trenches taken by the enemy have excited considerable comment because of the complete manner in which they are fitted up. Many of these trenches have been found to be unaffected by the heaviest bombardment. Some of the shelters taken had been excavated to a depth of about forty feet. They had galleries one hundred and fifty yards long and seven feet high. Large rooms opened out from the galleries. Both galleries and rooms were lined with strong timber. Ventilation was afforded by oblique shafts. The exits, of which there were many, consisted of staircases. The steps were fitted with steel treads, and ramps having a gentle incline.



The device is nothing more than a phonograph diaphragm and a horn which amplifies the weak sounds of the relay

Wearing Spikes on Your Feet to Prevent Slipping on Ice

EVERYBODY knows the difficulty of maintaining a foothold when walking on ice or sleet and slush-covered streets. A device which can be worn either on shoes or rubbers to prevent slipping has been invented by C. A. Anderson and G. H. Schepstrom of Illinois. Mr. Anderson, who is a shoemaker, noticed that every winter there was a demand for creepers but that few of the creepers on the market gave satisfaction to the wearers. Not having facilities to make the steel spikes necessary to construct creepers, he called for assistance on his friend, Mr. Schepstrom, who is a sheet metal worker. Together they produced a type of creeper which has distinct advantages over the ordinary kinds in use.



A new ice-creeper which may be worn over shoes, boots or rubbers. It is strapped on like a skate

The new creepers are fastened by straps in much the same way as are some skates. There are steel studs on both the sole and the heel which enable the wearer to stand securely in any position.

Applying the Principle of the Phonograph to the Telegraph Sounder

ON long telegraph lines, the current coming into a station is generally so weak that it cannot even pull down the magnet of the loud-sounding instrument. The current can, however, operate a small magnet on a very sensitive telegraph instrument. By making this small magnet close a heavy battery circuit in which the loud sounder is placed, the sensitive instrument acts as a relay and overcomes the difficulty.

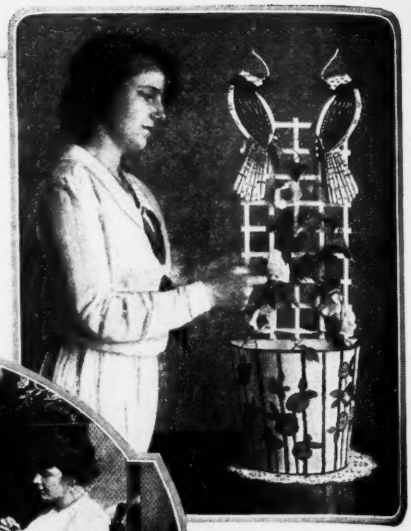
Extra batteries and instruments are therefore needed at every station. In any large size telegraph system, the expenses of their upkeep are considerable.

A very clever invention of R. A. and B. M. Grout, of Davenport, Iowa, does away with this expense by amplifying the weak relay clicks directly by means of a diaphragm and horn such as are used in all phonograph instruments. The weak clicks are transmitted to the diaphragm whose vibrations act upon the air and shoot their corresponding sounds out through the horn.

Housekeeping Made Easy

A lighter for starting fires without using paper. Into a decorative can holding kerosene an asbestos mop is dipped. When lighted, the mop is held under the wood until it catches the flame

The picture below shows a skein-holder for yarn. The yarn can be used directly from the holder, if desired, without the trouble of winding it into the usual balls



An ordinary tin pail decorated with hand painting and used as a flower pot for the porch or living room. An ivory-white lattice work on which gayly colored birds perch furnishes support for the plants

A new book-holder for the library table will please the automobilist

This unique tea wagon is provided with an electrical attachment under its metal cover

With this tiny grain mill you can grind your own corn-meal, a little at a time

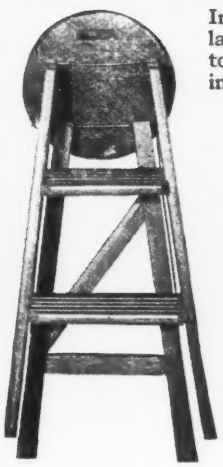
Housekeeping Made Easy

Below: A vegetable dicer. It cuts potatoes, carrots, etc., in small cubes without extracting any of the juices

A spacious kitchen cabinet which will accommodate every kind of kitchen utensil. It even has a ventilated compartment for food

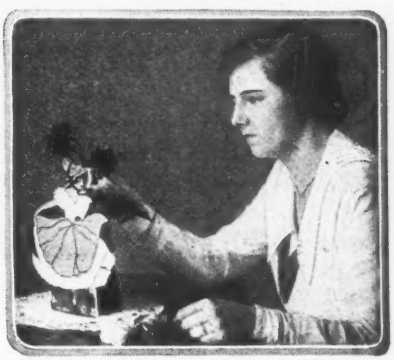
A sanitary case for the toothbrush. The tube of tooth paste is held in a clamp at the side. The base of the device is attached to the wall

In center above: A bookcase which has been transformed into a dolls' house for the nursery. Here the toys are kept dust-free and orderly



In center: A combination step-ladder and stool with large round top. It folds up to four inches in width and weighs six pounds

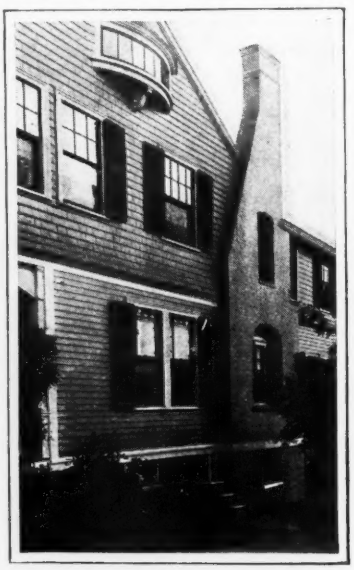
A light-weight magazine holder made of hand-painted tin which is decorative enough for an ornament



Carved wood figures are popular in decorations. Here a flower-holder is concealed by a dainty lady doll

A Chimney With Windows—But They Are Not Real

A CHIMNEY on the outside of a house is, in popular opinion, unattractive in spite of the fact that it is safer than an enclosed chimney. The builder of the house in the photograph worked out a novel effect by cutting windows through the brick to relieve the plain surface. Shutters were also provided so that the chimney windows might be in perfect harmony with those of the house proper. The windows are mere imitations, the flue being built up on the inside to insure a perfect draft. However, arrangements have been made so that it is easy to get to the inside of the chimney through the window spaces, when repairs are necessary.



To relieve the bareness of the brick wall of the chimney the builder provided dummy windows

Hang That Book from Your Shoulders and Read in Comfort

JOSEPH J. SLEEPER, of Philadelphia, had to consult a number of books of reference one day, and before he got through he was very tired. He then experimented with a shingle which he suspended about his neck by strings attached to the four corners. He found that he could rest his book on this and relieve himself from the weight, from the fatigue caused by stooping and from the eyestrain caused by reading a page not in proper focus. He could also jot down notes of reference without bending over or otherwise inconveniencing himself.

Since that early experiment the inventor has perfected a book rest which can be adjusted to individual requirements and which will support the weight of the book in such a manner that the hands are free. A lady who is anxious to knit for the soldiers may read and knit at the same time if her book is supported on a rest.

The device is constructed of two parallel angle bars which are connected with a sheet metal book-supporting tray. The tray will fold against the bars so that the book rest can be stowed away in a very small space when not in use. The book support may be used on the table in such a way that a paper or book may be propped up against it. A great convenience for the early morning commuter who likes to devour his news with his breakfast!

The device might also prove exceptionally useful to the musical director.

A new book or music rest which may be suspended from the neck

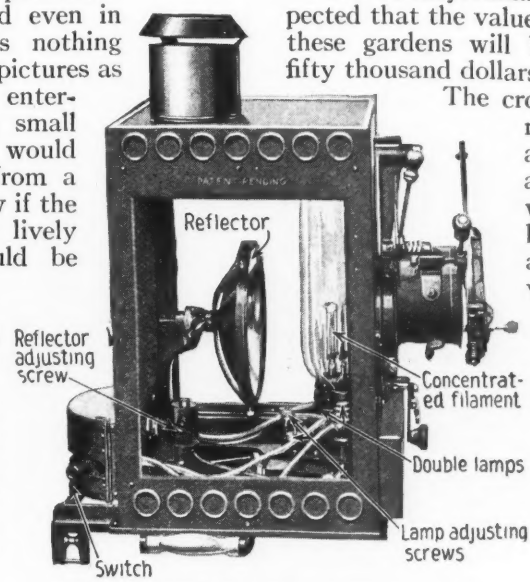
A Telltale Echo—It Repeated Secrets of the Confessional

IN Shipley Church, Sussex, England, there was formerly an echo which repeated sounds twenty-one times. The most remarkable of all multiple echoes was that of the Simonetta Palace, near Milan, which repeated the sound of a pistol shot fifty or sixty times. In the cathedral of Girgenti, Sicily, it is possible to hear, on the steps of the high altar, remarks in an undertone made at a place near the main entrance, a hundred feet distant. A confessional was once indiscreetly placed at this spot, and the discoverer of the echo is said to have amused himself by listening to the confessions of many fair penitents.

Incandescent Lamps May Now Be Used to Project Motion Pictures

IT has always been more or less difficult to give motion pictures in places other than a regular theater equipped for the purpose. A lamp has been devised recently which will make motion pictures possible in churches, schools and even in the home. There is nothing which equals motion pictures as a means of popular entertainment. Many a small fair, held for charity, would be more successful from a financial point of view if the added attraction of lively motion pictures could be offered.

A low voltage concentrated filament lamp has been developed which may be used with a new lamphouse designed especially for motion picture use. The lamphouse contains a double lamp holder with several adjustments, a reflector and two sets of condensers, one for stereopticon and the other for motion picture use.



Details of the low voltage concentrated filament lamp and lamphouse for motion pictures

A compensator with ammeter and resistance regulator is used for alternating current and a small rotary converter for direct current. Where the amount of electricity consumed is not important a specially designed resistance with ammeter may be used on direct current.

All conditions which might make operation difficult may be met by the use of this lamp and lamphouse. A twelve-foot picture has been shown successfully at one hundred feet. The apparatus may be used, however, to project small pictures such as would be suitable for an entertainment to be given at home.

The War Gardens of Railroad Employees and Station Agents

STATION agents of many railroad companies have become war gardeners this year. There are one thousand two hundred such war gardens on the vacant lands of the Pennsylvania Railroad. It is expected that the value of the crops raised in these gardens will be two hundred and fifty thousand dollars.

The crops tilled by the railroad employees average a little less than an acre. They are planted with potatoes, peas, beans, tomatoes, corn, and various other vegetables.

An agent on the New York Central, stationed at Chaumont, New York, has specialized in beans. He planted a plot one thousand five hundred feet long and twenty-five feet wide on the offside of the station platform.

A Dipper Dredge That Served as a Temporary Dry Dock

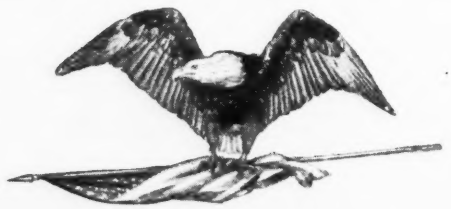
THE propeller of a tug on the Black River was injured. It was necessary to straighten the propeller shaft. But the owners did not want to put the tug in dry dock. So the dipper of a dredge was lowered on to the stern of the tug. Then a cable was passed around the hull of the tug and fastened to the dipper. When the dipper was raised the stern of the tug was lifted out of the water to allow the propeller shaft to be taken out. The shaft was straightened and replaced in much less time than if the tug had been put into dry dock and with no inconvenience.

How a tug was raised out of the water by the dredge and held until the propeller shaft was repaired

The Eagle Spreads His Wings

By Waldemar Kaempffert

How 23,625 American airplanes will be built at the rate of 3,500 a month to crowd the Germans out of the air

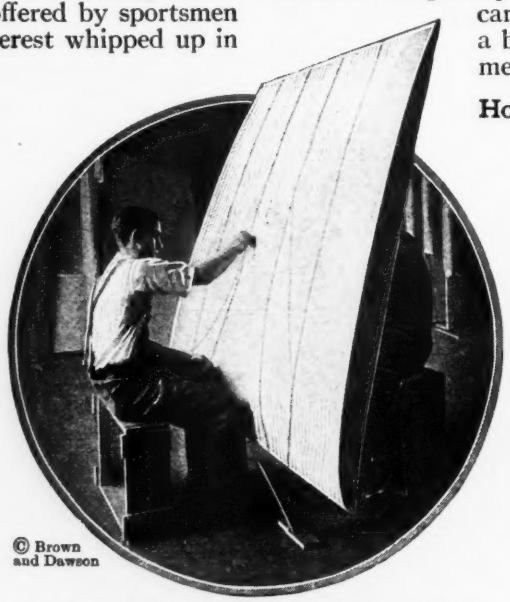


The Liberty motor, which will solve the engine problems of the airplane, and how it will be built

BETWEEN 1908 and 1916 our army ordered fifty-nine airplanes and received fifty-four. In 1916, with the possibility of being plunged into the war ever present, orders for 366 machines were placed, but only sixty-four were delivered. Even little Bulgaria in time of peace had almost three times the number of airplanes that we owned when we declared war.

And now we are planning to build 23,625 airplanes at the rate of 3,500 a month. From less than a hundred a year to over thirty times that number in a month!

Airplane building is essentially a military industry. The great French and German builders of flying machines would have starved to death had they been dependent on the general public, and this despite the rich prizes that were offered by sportsmen and despite all the interest whipped up in flying contests by the daily press. Because the airplane builder never received adequate support from the Government we have to create a real industry. In 1916 the American airplane industry, such as it was, had a capitalization of only $50,000,000 and gave employment to about 14,000 men. The money invested in the airplane industry of England now amounts to $375,000,000; the number of employees is 66,000; the capacity of the plants is 41,000 machines a year. Compare these American and English statistics and it will at once appear how much ground we have to cover.



© Brown and Dawson

Stitching the fabric of a stabilizing surface. Linen, for which we depend on Ireland, is used

Unfortunately the airplane is not like the automobile. It can hardly be compared, from a manufacturing point of view, with anything in the world.

The Automobile and Airplane Compared

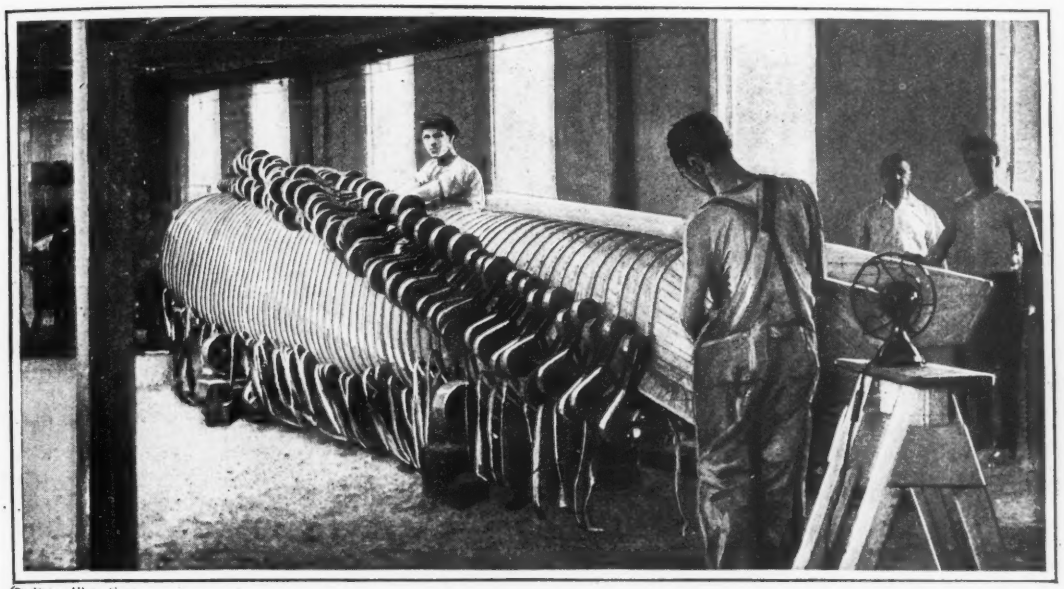
It does not matter very much whether an automobile engine weighs thirteen, fourteen, or fifteen pounds to the horsepower. An automobile-engine maker can think and work in pounds; but the airplane maker must consider ounces. The airplane itself is essentially a lifting device. It must elevate and transport not only itself but a useful load. The less of itself that it has to lift the greater the load that it can carry. Sometimes it must be fast—faster than any artificial thing except a bullet. Great speed can be attained only with a bigger engine, and that means more weight.

How An Airplane Engine Is Built

To make an automobile engine, molten metal is poured like so much water into a mold of sand; when the metal cools the crude form of an engine congeals. The Liberty motor is not so easily produced; it is machined out of a solid block of steel—the very best steel that the most knowing metallurgists can produce. The casting of an automobile engine is a matter of minutes; the machining of a Liberty engine is a matter of hours, even days. Automobile engines are produced by the hundred in the working day

of many a plant; but the best airplane plant in the country now produces only five engines a day.

The difference between an automobile and a Liberty engine is as the difference between a cheap alarm clock and the finest chronometer: The excess metal on as many as eighteen automobile-engine castings is sliced off at once like so much butter by huge automatic machines. A single machine-tool will bore out or ream as many as half a dozen automobile-engine cylinders to receive their pistons. Automatic machines are also found in airplane-engine plants; but the airplane-engine is essentially the product of the craftsman rather than of the machine. The magnifying glass is not an essential tool in the making of an automobile engine; it is never missing in the airplane-engine factory. And why is it used? Simply to examine steel for minute flaws. It is unnecessary to worry much about the interior of pipes or crankcases in making automobile engines; if an automobile should stop in the middle of the road for no apparent reason no one is endangered. But if a Liberty motor should suddenly stop in midair a brave man may lose his life. That is why the maker of Liberty motors scrapes the interiors of pipes and crankcases. Little grains of sand imbedded in the metal are picked out by hand, because if the minutest particle should find its way into the cylinder or into a bearing, the engine must suffer. If even the head of a screw is slightly mutilated in driving it home or a pipe is ever so slightly indented that screw and that pipe must be rejected. And so it is with every part. Every third man in the engine plant is an inspector—usually a Government inspector. Fully sixty per cent, sometimes eighty and even ninety per cent of the parts produced are rejected. Is it any wonder that Liberty motors are worth five and six thousand dollars apiece, and that there is less profit in selling them at that high price than in selling automobile engines of equivalent horsepower?



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Wrapping fabric around the body of a fuselage. Note how the strips are held during the application. Each strip has been carefully tested, and so has every piece of wood

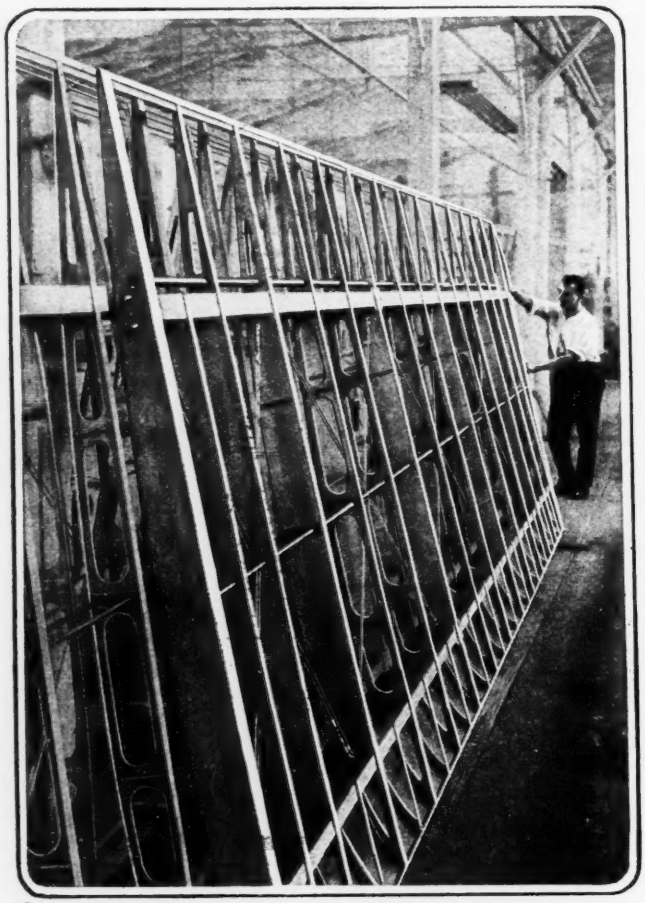
Climbing and What It Means

Yet despite all this care the engine is not perfect. When you want it to do its best it does its worst, which means that at high altitudes it is least instead of most efficient. A mountaineer who must first climb two miles before he can fight is in the same position as a fast fighting airplane. He has had all the hard work of climbing and must then puff very hard in order to inspire enough air in a rarefied atmosphere. An airplane must climb five, ten, fifteen, even twenty thousand feet, and the higher it climbs the less power is delivered by the engine. The engine cannot breathe as much air as it requires, and air is as essential to an engine as

it is to a mountaineer. When two fighters seek to kill each other three miles above the earth every bit of extra power counts. All this means that although an engine will weigh only three and one-half pounds and even less for each horsepower developed at sea-level, it weighs very much more for each horsepower the higher it climbs; it is much heavier than it ought to be.

Painstakingly built as they are, airplane engines must be scrapped or rebuilt at the end of eighty or a hundred hours. By that time the bearings are sure to be scratched; carbonization has set in; other defects appear. It is said that a man is rebuilt every seven years in that ever-recurring process of discarding old tissues for new. An airplane engine is rebuilt every few days. New parts are constantly substituted for the old, until very little of the original construction is left. Even a single steep, long dive means overhauling. Flames due to excess of gasoline, and smoke due to the oiling up of the front cylinders, pour out of the exhaust. The sparkplugs must then be renewed. Indeed, sparkplugs are the engine-maker's bane. They must be renewed after a few hours in order that they shall not fail in the air.

The Liberty Motor is not essentially different from other airplane engines. But it will be put together in a new way. It is standardized. And that means—? Simply that cylinders can be combined to produce an engine of any desired power; that the nuts and bolts made in Boston will fit the threads tapped in a part made in Detroit; that the elements of the engine are interchangeable so that a power plant can be improvised on the spot.



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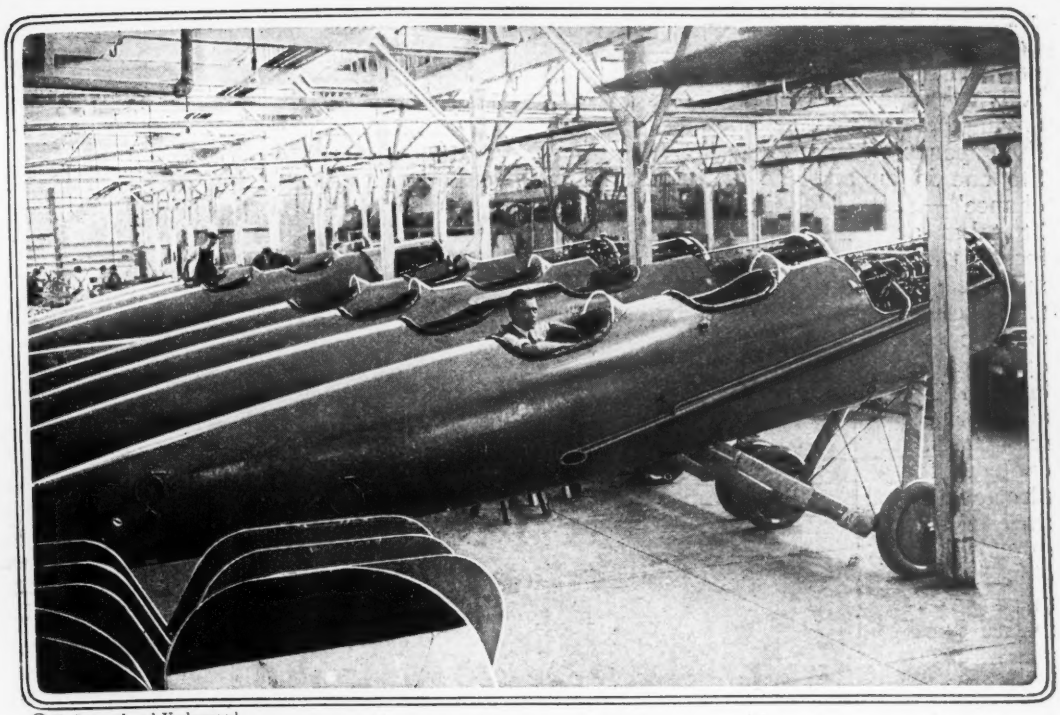
The frame of an airplane wing is made of spruce. It takes only two hundred feet of spruce to make an airplane, but one thousand feet must be examined and eight hundred rejected to obtain two hundred perfect feet. A wing must be as strong as a bridge and yet as light as possible

The Sensitive Air-Propeller

Propellers are hardly less delicate than motors. They are almost humanly sensitive to temperature. In the dry altitude of the Mexican border, of northern Africa, of India, and of Bagdad, days are hot and nights cold. Hence propellers buckle, warp and fall apart in the air. That disintegration is highly dangerous; for a blade may smash the front of the airplane and kill the pilot. Propellers for use under such trying circumstances in the tropics are now made on the spot. But wherever they are made the best woods are used, usually walnut and mahogany. They must be balanced with the utmost nicety. The speed at the end of the blades is seven miles a minute. Hence the least nick throws the propeller out of balance, which may mean a wreck.

No less difficult is the making of the wings. They must be as light as a feather and as strong as a bridge. Flimsiness and strength—could anything be more paradoxical? Yet the whole machine itself is a



© Underwood and Underwood
Thousands of such machines must be made if we are to win the war in the air. Airplanes must be built on the progressive assembling system adopted in automobile plants. We must be prepared soon to make three thousand five hundred airplanes a month

kind of mechanical paradox. The frame of the wing is in effect a very carefully designed, very carefully constructed bridge. There is probably no other structure in the world that is so light and yet so strong. A pilot who flies at a speed of over a hundred miles an hour, who climbs more than six thousand feet in seven minutes, and who makes a sickening drop two miles in the air in order to escape an adversary subjects his wings to terrible strains. Cyclones, which are nothing but winds traveling with airplane velocity, blow down houses and uproot trees, because the houses and the trees are not stiff enough to withstand such enormous pressures. The modern airplane is a storm machine. It forces itself through the air with cyclone speed; which means that it is subjected to exactly the same pressures as if it were lashed firmly to the ground in the worst Kansas cyclone. Years of research and mathematical calculation have taught the airplane builder how to make a wing so strong that it is not likely to snap off like a clay pipestem.

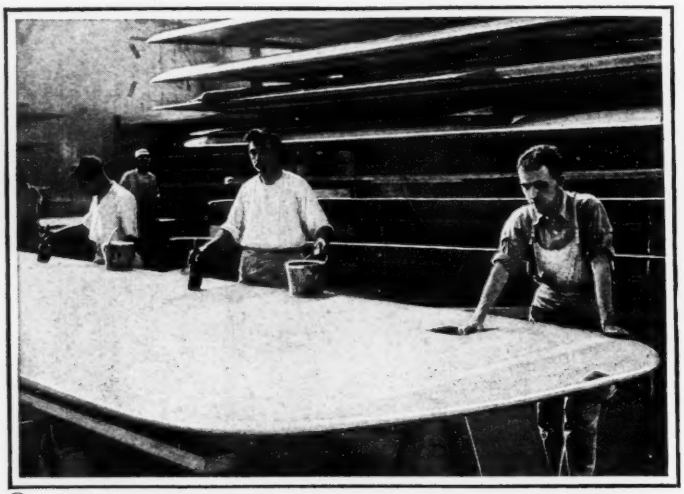
© Brown and Dawson
No iron cross for us, but the red, white and blue of Liberty

Where Shall We Get Spruce?

To make the wings strong, yet light, spruce is used. If we are to build airplanes at the rate of 3,500 a month we must make deep inroads into our forests. There is none too much spruce of the superior kind required for airplane construction. It is hard to find good wood. But the task of building wings is further complicated by the fact that although the spruce is bought by experts, fully two-thirds of it is rejected because of its faulty grain or some other defect.

The building of an airplane wing is hardly a commercial art. It is

more like the fashioning of some exquisite musical instrument. Stradivarius never selected the wood for his violins more carefully than the men who shape the spars for a wing pick their pieces of spruce. Human life depends on the proper choice of wood. No one in an airplane factory "takes a chance"—least of all in building a wing. It takes at least a thousand feet of this carefully selected spruce to build a single airplane. We must find enough for thousands and thousands of machines. To meet the demands of present English construction alone, more spruce is wanted than the entire present annual output of the United States.



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The fabric of an airplane wing must be as tight as a drumhead. It is therefore stretched to its limit of endurance and coated with a preparation termed "dope," a nitrocellulose compound which is thus far the best coating discovered

Perhaps the most serious problem with which we are confronted in building whole flocks of battle eagles within the time demanded by our allies is the necessity of air-drying the spruce. The wood cannot be used as it comes from the forest and the mill. It must be seasoned, preferably air-seasoned, a process that requires about nine months. The Bureau of Standards is at work on the problem of devising a means of so treating the wood that it can be used in building wings soon after it is cut; but even such research takes time. Some efforts have been made to use steel. Perhaps our salvation may lie in that procedure. Airplane builders, for the most part, prefer spruce to steel; it is lighter and stronger per pound.

The difficulties of building 23,000 airplanes in a year or less, difficulties inherent in the very nature of the flying machine as well as in the scarcity of material are not disheartening. Automobile production methods must be adopted; which means minute subdivision of manual and machine work, and above all standardization. Factories must concentrate on one or two types.

The surveys of the country's manufacturing facilities made by the National Advisory Board and the Aircraft Production Board will enable us to avoid most of the mistakes made by England during the early months of the war. Automobile makers and munitions manufacturers must be taught how to produce good trustworthy engines and cylinders; furniture makers and coach builders must learn how to make wings to which human lives may be trusted; sewing machine and typewriter companies must also coöperate if we are to turn out 3,500 machines a month. England has taught us the way. At present no fewer than one thousand British factories are engaged in making parts for flying machines.

The Aircraft Production Board has done invaluable work in standardizing the airplane. The wonderful Liberty engine has been created—the composite invention of the foremost authorities on metals, radiators, cooling, carburetion, and ignition. The Board will determine the sizes of nuts and pins and wires. They vary now. It should be possible to build an airplane on the battlefield from the parts of several old machines. How can that be done if a bed will receive only a certain size and type of engine, if nuts will not screw on the bolts at hand, if, in a word, parts cannot be interchanged?

There are far too many types of airplanes now. France entered the war with no less than thirty. Of course she could not foresee in 1914 that half a dozen would suffice, simply because the half dozen that have been developed are utterly different from the thirty that marked the pinnacle of achievement in 1914. Standardization sometimes means stagnation; but military exigencies will prevent that at this time.

Using Brine Baths as a Cure for Shell Shock

MANY officers and men are returning to England suffering severely from shell shock and other ailments contracted in the trenches. The peculiar nervous condition in which these men find themselves is difficult to treat. At Droitwich, England, are some remarkable natural brine baths which have done much to restore these unfortunate victims of the war to their normal state.

The treatment consists of a number of baths such as douche, needle and spray. Men who are able to swim are encouraged to use the swimming baths. There are a number of these. In cases of rheumatism and frost-bite much relief has been obtained through the use of a brine spray and massage. The attendant has a hose attached to his arm so that he can massage and spray the patients at the same time. This hose is used to spray the more delicate portions of the body. At the same time, a stronger spray from a wall-shower, shown at the back of the patient being treated in the illustration, keeps the entire body well doused. At first the brine spray is applied warm. The invigorating effect is soon felt, however, and after a few treatments the patient is able to stand a cooler temperature. Soon he enjoys a cold spray, and before may days have passed at the baths he is able to carry on his own treatment in the swimming pool.

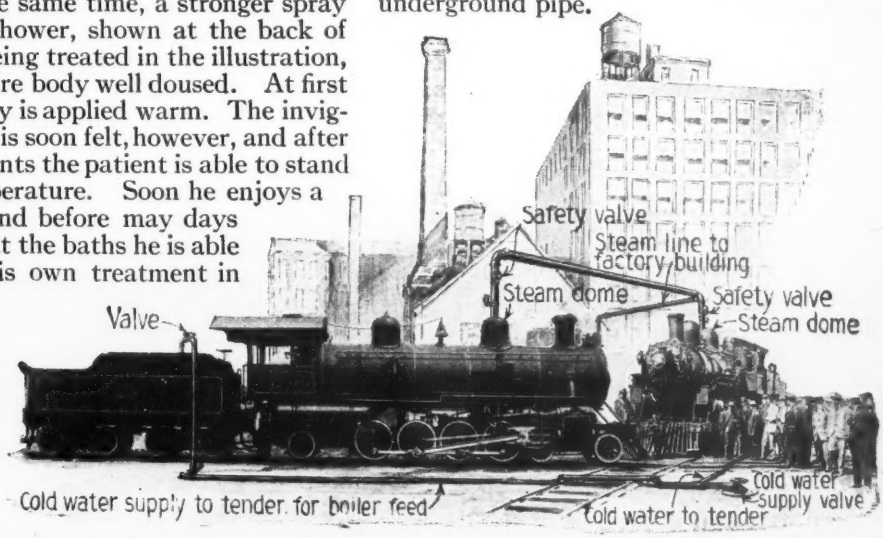
More than 22,000 cases have been treated at the Droitwich salt baths free of charge.

A soldier suffering from shell shock being given a brine bath and massage at the same time

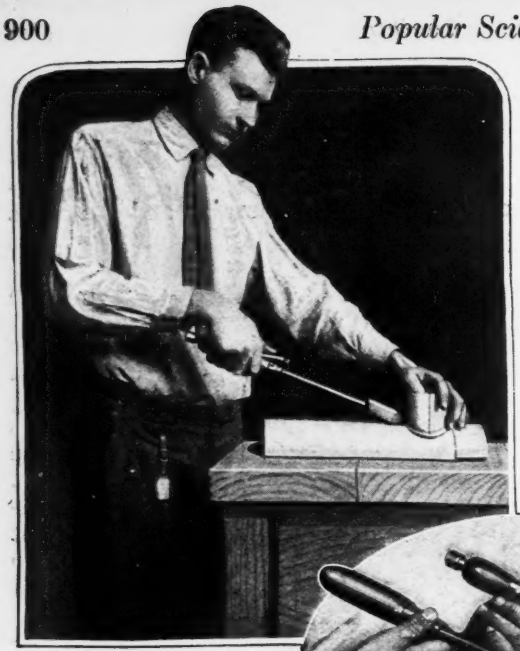
Two Locomotives Supply Heat to a Manufacturing Plant

A LARGE manufacturing plant at Arlington, New Jersey, was cold as a refrigerator one winter's morning and there was no immediate relief in sight. It seemed as if the three eight-hour shifts of three thousand employees might have to be dismissed. There was no time to install a new heating plant; besides that would have been too costly. The superintendent wanted just enough steam to furnish heat for a few hours.

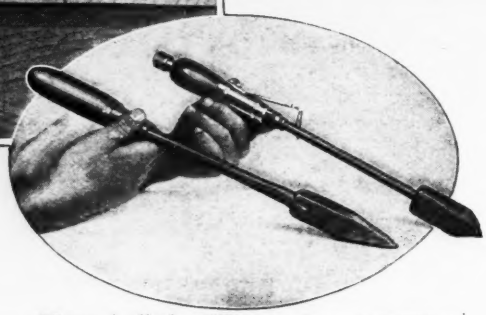
Two Erie locomotives were placed on a side-track, a steam line connection was made between the hot water pipes and the steam dome of each engine, and the plant was heated at an expense of fifty dollars for the day, which was the cost of the engines and fuel. Valves were placed at the points shown in the drawing to enable the source of steam to be controlled. Cold water was supplied to the tenders by an underground pipe.



How two locomotives supplied steam heat to the three thousand shivering workmen of a manufacturing plant last winter when the heating system was out of order



A lever operated by the thumb of the hand holding the soldering iron feeds the solder pellets down the hollow shank to the point



There is little difference in appearance between the new iron and ordinary types

pellets pass, from becoming clogged on account of the oxide from the copper, the inventor tinned the passage. As a further means of keeping the new soldering iron up to its maximum efficiency, he made the part of the iron containing the tinned passage easily detachable, so that there would be no difficulty about cleaning and retinning the passage occasionally. But since the tin is not exposed to the air, it lasts much longer than it would if it were on the outside. If the copper should be allowed to become red hot, or "burn up," as it is called, it would, of course, destroy the tin; but if the tool is kept at the right soldering heat the tinning will last almost indefinitely.

Doing the Work of Three Hands with Two, on a Soldering Job

WHEN a careful workman has a difficult soldering job he often feels that two hands are not enough; yet a helper, especially if he is inexperienced, is more likely to be in the way than helpful. So thought Ray M. Tilton, of Panora, Iowa, when he first began work on a soldering iron which would hold its own solder and apply it where it was needed, leaving the operator's left hand free to hold the work. Mr. Tilton employs a magazine in the handle of his soldering iron. In this the solder is kept in small pellets, which may be fed down the hollow shank directly to the inside of the hot copper point of the iron. Naturally when the solder pellets encounter the hot point they melt and flow in liquid form directly on the spot to be soldered.

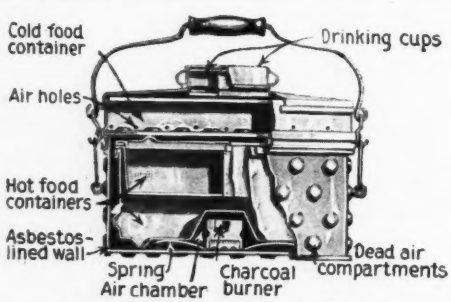
In order to prevent the passage in the copper, through which the

The "Complete Dinner" Container for Long Trips

HERE is another ingenious "full dinner pail" which keeps hot things hot and cold things cold. It is the invention of Julius E. Heimerl. It has three separate compartments, one for hot foods and one for fruit, cake and bread, etc. The third holds a fuel box.

The container itself is a metal box having a handle like that of a pail and a lining of heat-insulating material. The hot meat and vegetables are placed in the compartment directly over the fuel box. The heat from bits of burning charcoal in the fuel box keeps the food piping hot until served.

Holes are provided in the walls of the compartment for fruit and foods to be served cold, so that air may circulate freely through it. In the flanged cover of the cold food compartment a cup is set which may be used as a food container or as a drinking cup. Another cup fits over it as a cover. This, too, may be used as a drinking cup. Just above the fuel box is a space large enough to accommodate a coffee pot, so that by adding enough charcoal to boil the water, coffee or other beverages may be readily prepared as needed.



A compact food container with compartments for hot and cold food

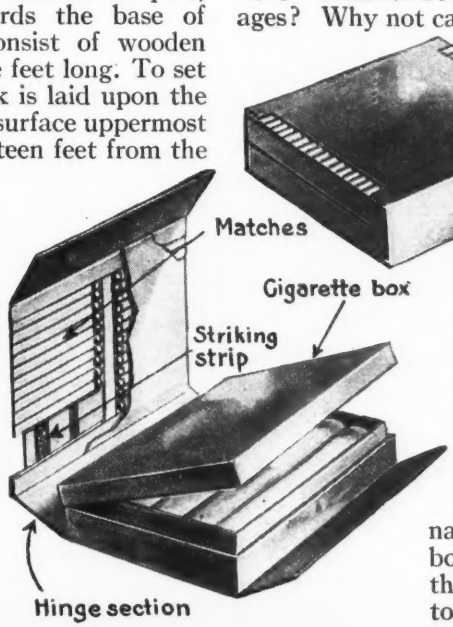
Which Way Will the Tree Fall? A Machine Which Controls the Direction

By pressing forward and upward on levers, the workmen are able to make the pole exert a strong pressure against the bole of the tree, compelling the tree to fall in the desired direction

TREE felling machines not only facilitate the felling operations but also reduce the hazard and the consequent damage. The machine shown in the accompanying illustration consists of a pole, a plank, and a pair of levers. The pole is usually three to four inches in diameter, fifteen to twenty feet long, and often shod at the upper end by a metallic socket armed with a spike and at the other end by a similar but larger socket armed with a toe and two lateral projecting pins. The wooden plank is about eight feet long, four inches thick, and eight inches wide. It may be simply notched regularly on the upper surface, so that it presents an appearance similar to an ordinary washboard, or it may be surfaced with a firm corrugated metal. At regular intervals along each side of the plank are about twenty-five projecting pins. By pressing forward and upward on levers and changing their hold the workmen are able to move the base of the pole, groove by groove, towards the base of the tree. The levers consist of wooden handles usually about five feet long. To set up the machine the plank is laid upon the ground with the grooved surface uppermost at a distance of ten to fifteen feet from the tree to be felled. In case of large trees and sometimes in wet or snowy weather it may be necessary to fasten the plank to prevent slipping. This can readily be accomplished by driving a stake into the ground against the far end of the plank or by tying the near end of the plank to a nearby tree, or even to the stump of the tree to be felled, provided it is not being taken out by the roots. The pole is then placed against the tree in an inclined position with the spiked end fixed against the tree trunk and the other end armed with a toe resting temporarily in a groove towards the far end of the plank.

Pull Out a Cigarette and a Lighted Match with One Motion

WHY should cigarettes and their matches be packed in separate packages? Why not carry them in one, and not two, boxes? So thought George E. Lamberson, of Brooklyn, New York, and he devised a box to hold cigarettes, matches and sandpaper to ignite the match as it is drawn out of the box.



A thin wrapper on the lid of the cigarette case holds the matches. The ends extend as shown above

The ordinary cardboard cigarette box is surrounded with a thin wrapper, which serves to hold the matches.

His Majesty, the Turkey

How the young birds, more delicate than babies, are coaxed along to your table

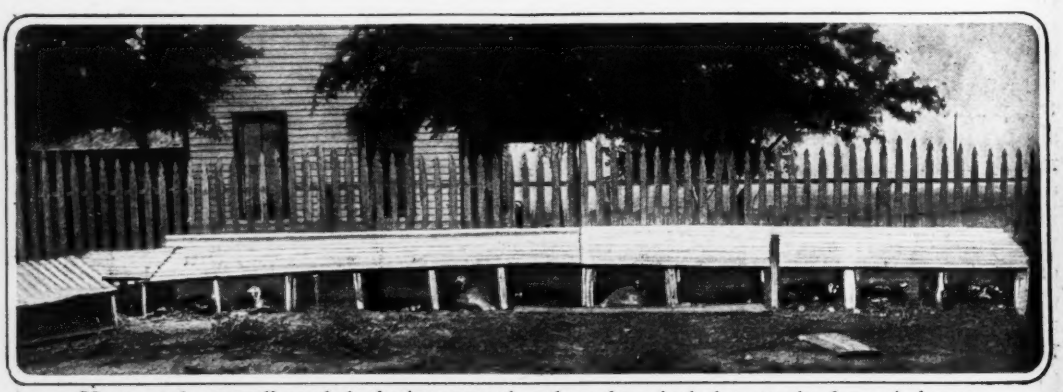
ON turkey ranches the flocks are managed like sheep. By day they are herded by men on foot and horseback and by dogs specially trained for the task; at night the flocks are driven home to roost. But the small cultivator of turkeys has discovered a way around the natural roving instinct of the fowl. In order that he may not lose a good portion of his flock, or all of them, through their wandering too far away, he keeps them confined in a lot of about an acre or more, until noon time, when he lets them roam where they will. The reason for this is that turkeys do most of their roaming in the early morning. During the middle of the day they loll about in the shade, starting toward their roosting place as the afternoon wanes.

The inexperienced may find difficulty in locating the nests of the turkey hen, but to the initiated rancher the task is easy. He simply keeps all the hens penned up until late in the afternoon. When they are finally let out, those that are laying will strike out on a run in a bee-line for their hidden nests.

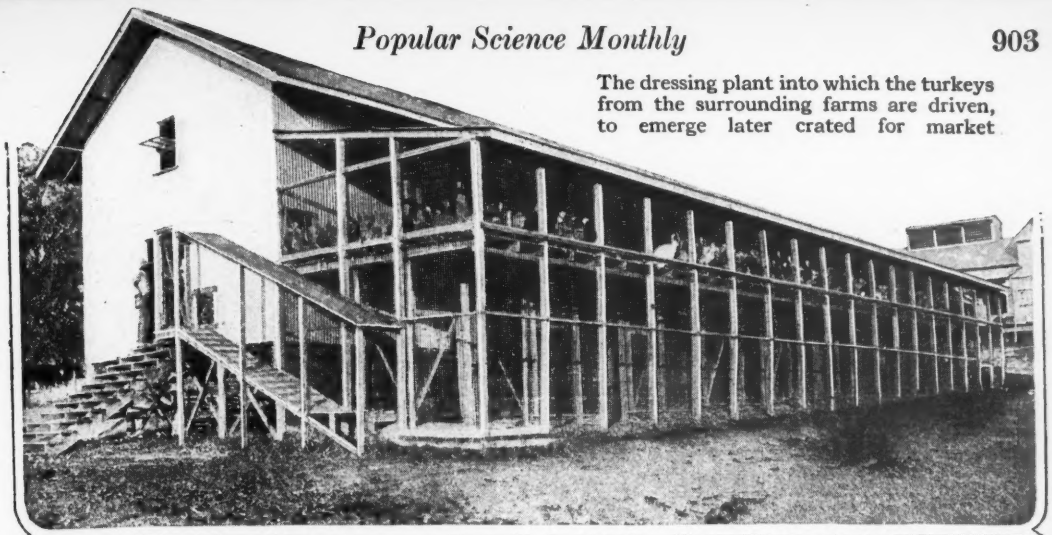
The eggs are gathered daily after the turkeys have gone to roost, so as to prevent them from being chilled or stolen. When the hens become broody they are allowed to sit on about eighteen eggs, which hatch out in about twenty-eight days. Then, according to the poulterers, the turkey-raisers' real troubles begin. The young poults are more delicate than babies and require constant care. This means that the youngsters catch cold easily from wet feet and from dampness in general.

In the illustration pictured below, a method is shown of housing the nesting turkey hens which minimizes the danger from dampness. The birds are placed in an enclosure as close as possible to the farmer's house, so that they may be easily watched and cared for. The nests are made on well-sanded and preferably slightly sloping ground, under a low shed, each nest being tightly enclosed on three sides and open toward the south. Here the young birds can be given constant oversight. After the poults have feathered out there is little further trouble with them.

About the first of October, fattening is begun by gradually increasing the evening allowance of grain. Soon afterwards comes the marketing period. This, among the small poulterers, is preceded by a regular turkey-picking bee, similar in social jollification to the corn-husking bees, famous in song and story.



Nests made on well sanded, sloping ground under a low shed close to the farmer's house where the birds can be under constant watch. Each nest is open only on the south

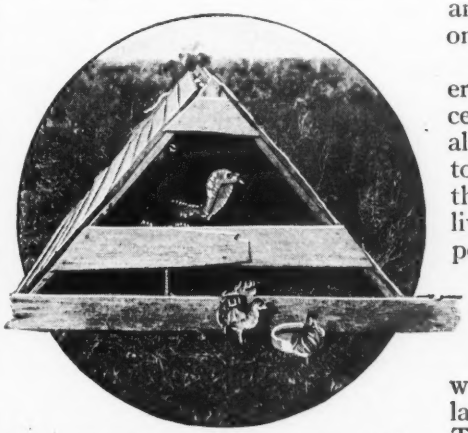


The dressing plant into which the turkeys from the surrounding farms are driven, to emerge later crated for market

Flocks composed of a thousand or more turkeys are sometimes driven miles to the community dressing plant. Stops are made at nightfall near a grove of trees where the birds may roost

In most large turkey-growing districts, however, dressing plants have been built to handle the birds during November and December. During other months of the year the plants are used as clearing houses for butter, eggs and other farm products. Here the turkeys are killed and dressed as quickly as possible after their arrival to prevent shrinkage in weight. Often huskers in the vicinity of a dressing plant will go out through the surrounding country and buy up from the farmers all the available turkeys, driving them in to the dressing plant in flocks of sometimes a thousand or more birds.

At the dressing plants the turkeys are driven into cages arranged in long rows and leading through an alley into a smaller inner cage. Not more than twenty turkeys are allowed to remain in the inner cage—or dressing room—at one time. This is to prevent the pickers from choosing the smallest and most easily picked birds and leaving the large ones for the last.



An economical brooding pen in which the motherbird is kept from straying

Although it is considered best for all concerned to ship the birds already killed and dressed to market, on account of the heavy shrinkage of live birds during transportation, the rule is not arbitrary. In fact, there is a special train, known as the "turkey special" which travels regularly from Morristown, Tenn., to New York loaded with live turkeys.

A Pelican in Your Wardrobe to Hold Your Coat

AMONG the many wooden novelties which have been brought out this year, the pelican coat hanger is conspicuous because of its amusing appearance. The bird is painted in vivid colors. A flock of bird hangers adds to the attractiveness of any wardrobe. The bill and tail of the pelican support the shoulders of the coat, while the collar fits around the body of the bird.

These novelty coat hangers are especially approved for use on the clothes-tree, where the coat is usually hung more or less carelessly because hangers are not provided there. The gorgeous pelican is so ornamental that there is no objection to his remaining in full view when not in use, wherever he may be.

The pelican coat hanger. A wooden novelty, designed to keep your clothes in shape

We Exclude the Chinese but Not His Queue and Combings

ALTHOUGH the traffic in human hair has not been so brisk during the past few years as formerly on account of the veering of the fashions in hairdressing toward the extremest simplicity, still there are millions of pounds of human hair exported from China. One of the peculiar facts in connection with the trade is that often after the Chinese send the hair to us we treat it and dye it and send it back to be made up for special use. This is usually true in regard to the invisible hair nets which American and European women use to keep their own locks in order on a windy day.

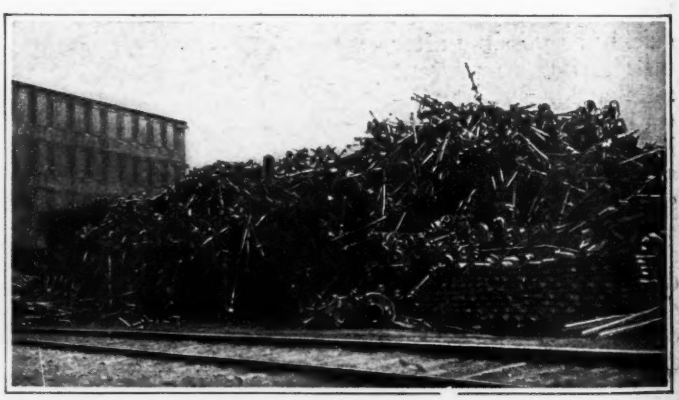
The hair-net business has become of great importance to the province of Shantung, which now provides practically the entire supply for the market. Thus the hair net worn by the veriest stay-at-home in America has doubtless crossed the ocean three times.

Since the abolition of the queues after the recent fall of the Manchu dynasty, long pig tails of Chinese hair are no longer readily available. The dealers are relying more and more on the combings of women, although there are men who make it a part of their business to let their hair grow to about eight inches in length and then sell it to the barber who in turn sells to the small trader in hair. For exporting, hair is assorted according to length and tied in bunches. Most of the exports go to England, France and the United States, where the hair is bleached with peroxide, thinned with acid and boiled in dye. It is thus rendered finer in texture and, incidentally, absolutely sanitary. The appearance of the hair is also completely changed.

New Looms for Old—A Wartime Improvement Demand

NOW, as never before, the manufacturers of wool and cotton fabrics feel the need of putting in new machinery, on account of shortage of labor and other industrial conditions due directly to the war and to the cutting off of immigration.

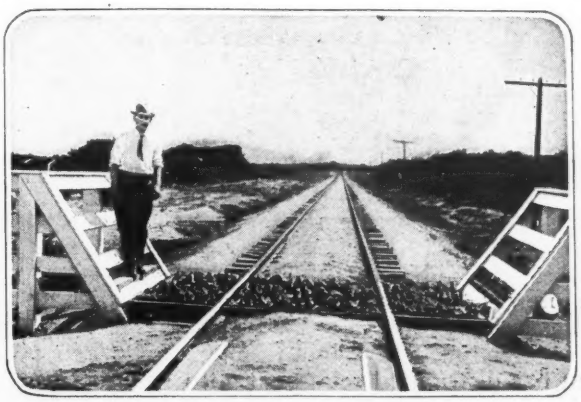
Thousands and thousands of old looms are making scrap heaps like the one below.



This mound is made up of scrapped looms which have had to make way for new ones requiring fewer workmen

A Cattle-Guard Made of Cactus. Horses and Cows Avoid It

AN ingenius foreman on an Arizona railroad recently conceived the idea of using the cactus plant as a cattle-guard at railroad crossings. The first, which was planted a few months ago, has proved an unqualified success. Not a single animal has attempted to cross it. As a matter of fact, both horses and cattle are thoroughly familiar with the species of cactus used, and fight shy of it as they would of a rattlesnake.



The cactus hedge for railroad crossings. The frames at the side furnish a footing for workmen

A frame of two inch by six inch timbers was placed on edge and fitted between the tracks. In the bottom of this structure are a few inches of sand and gravel in which the cactus plants were placed. The cactus is very long lived, but as it grows in abundance along the railroad, it can be renewed if necessary. As the thorns will pierce an ordinary boot or shoe, it was necessary to place a piece of timber along the bottom bar of the fence to allow employees to cross.

This is by far the cheapest form of cattle guard in use on any railroad.

A Collapsible Concrete Form Which Works Like an Umbrella

A NEW type of adjustable and collapsible steel concrete form works on the principle used in constructing the ribs of an umbrella. The form is made in two types, one for circular culverts and the other for small bridges with semi-elliptical arches. Both types are collapsible for greater ease in shipment from point to point or for movement ahead, as each section of culvert or bridge is concreted and hardened in place. Each type is also adjustable, the culvert type from twenty to forty inches in diameter and the bridge design from spans of six feet to forty feet. The fact that both units are adjustable within such comparatively wide limits greatly reduces the cost of the forms used because of their reduction in number. With the ordinary wood types a special form would have to be made for each diameter culvert or each differently spanned bridge. Because both types are of steel instead of wood, they last indefinitely and reduce the cost of form construction.

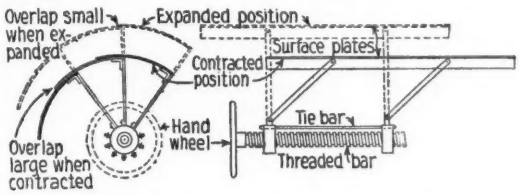
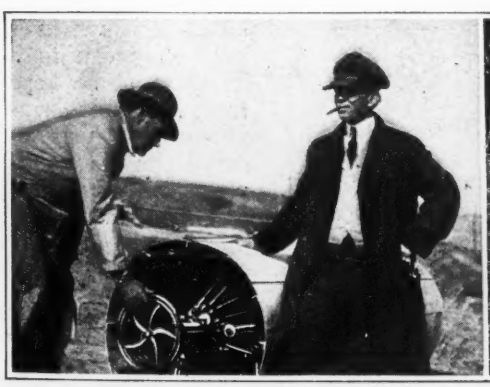
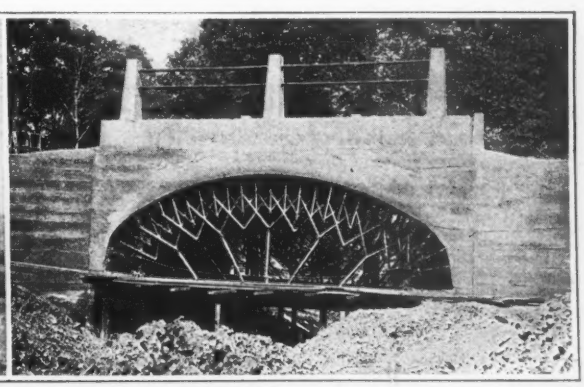


Diagram showing the principle on which the diameter of the form is increased or decreased



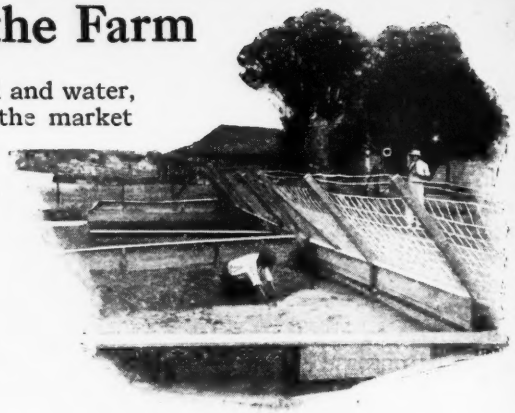
Turning the hand-wheel adjusts the angle of inclination of the radial arms



The adjustable bridge form. The overlapping surface plates are forced in or out

Raising Terrapins on the Farm

They require little more than sun, sand and water, and bring from $50 to $60 a dozen in the market



An enclosure 100 feet square will accommodate 750 adults and many young ones

GOOD Chesapeake terrapins measuring six inches in length on the lower shell bring from $50 to $60 a dozen in the city markets. Clearly, it would pay to raise these turtles extensively. The attempt has been made over and over again, but no private enterprise has met with any commercial success because the turtles would not hatch out.

In 1902 the Bureau of Fisheries began breeding terrapins in captivity. In the experimental pounds at Beaufort, North Carolina, there are now two thousand terrapins of various ages which have been hatched and raised in confinement. Beside these the Bureau has distributed several thousand terrapins in other places for experimental work.

The oldest brood in the Beaufort pound dates from 1909. The females of this brood have attained marketable size and have produced eggs. Some of the brood of 1910 also have grown large enough to be marketed.

The essentials of a good terrapin farm are some dry land for part of the day and some water all day. The females should be able to resort to sand beds when they desire to make their nests and they should have space in which to crawl about and sun themselves. Each adult terrapin requires ten square feet of space and each young one one square foot for health and comfort. An enclosure 100 feet square will provide satisfactory quarters for 750 adult turtles and twice as many young ones.

At Beaufort the terrapins are fed on fish with variety furnished by an occasional meal of blue crabs or fiddlers. In the winter the young terrapins are given oysters. The fish are cut into small pieces, and the crabs are crushed before being fed to the terrapins. The daily cost of feeding one hundred terrapins is only five or ten cents.

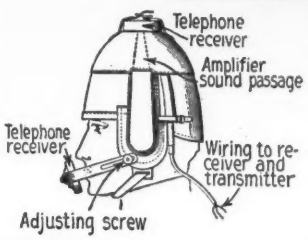
The terrapin is a hibernating animal. During the cold weather it burrows into the mud and remains there until the return of warm weather. The terrapin farmer need not dread disease among his turtles. Terrapins seem singularly free from epidemic diseases.

Diamond-back turtles hatching out in a farm hatchery at Beaufort, North Carolina. The objects resembling small stones are the eggs

Eggs are laid from May to August. The average number of eggs in a nest is from eight to nine, although as many as sixteen have been found. The young appear in August. They can climb over a concrete wall two or three feet high and crawl through any hole they can find. They must be kept from the adult terrapins while young because the older animals are likely to destroy them by trampling on them or by eating their food. This is not done through viciousness or even through greediness, but occurs accidentally.

To Open a Stubborn Knife-Blade, Throw It From You

THE next time the best blade of your pocket-knife refuses to open when you need it badly, give it a good reprimand and throw it away from you. But first place a corner of your handkerchief over the back of the blade and wind the rest of it tightly around the knife. Hold the opposite corner between the first and second fingers of your right hand, if you are right-handed, and give vent to your annoyance in the force of the throw. This will calm you considerably and by the time you traverse the distance over which you have flung the knife you will be in a forgiving mood. When you pick up the knife you will find the blade opened. This is a bonafide method which will open the rustiest of knives without injury to the fingernails.—C. S. MINTER.



Above: The helmet carries the telephone receiver and holds the transmitter in place

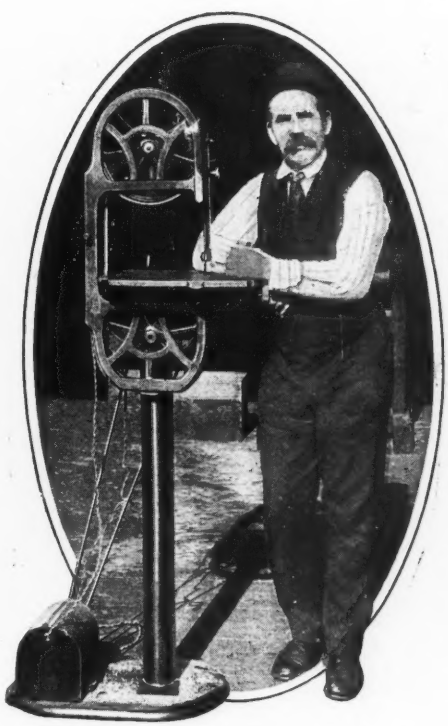
At left: Diagram of helmet and of the telephone appliances which make conversation in an airplane possible

The Smallest Bandsaw—A Time and Labor Saver

THE smallest bandsaw ever made is that recently patented by John A. Carlson of Seattle. Mr. Carlson was impressed by the need of a saw which would cut close on very fine work.

His small machine can be placed between every two benches. It is a miniature bandsaw which has all the features of the ordinary bandsaw and several others of special value in a pattern shop. It can be set on a standard on the floor or attached to a bench or table. It is electrically operated.

Among the unusual features are safety devices which make the tool practically fool-proof, a tilting table with degree register and a locking device.

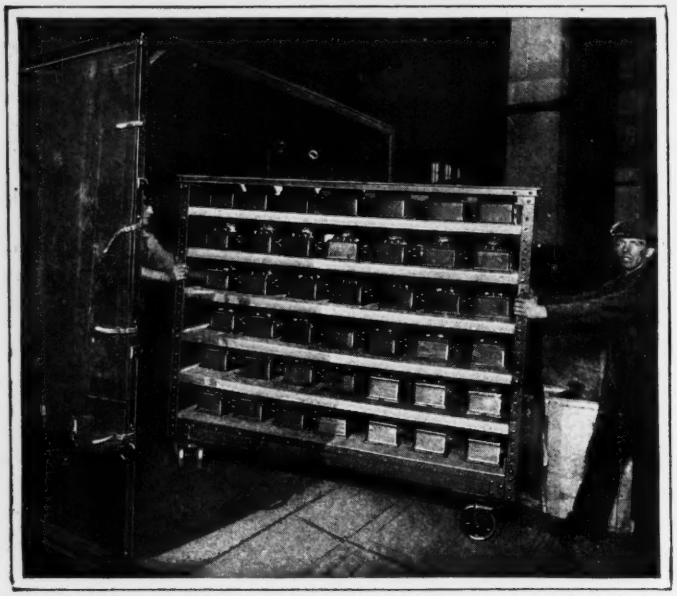


The smallest bandsaw and its inventor. It is practically fool-proof

Aviators Now Can Carry Their Telephones Under Their Hats

A NEW YORK man, Jesse L. Spence, has invented a helmet for the use of aviators which not only provides them with a head covering but a telephone as well. Any one who has ever tried to talk while in an airplane knows how difficult it is. The loud noise made by the engine and the high wind pressure make conversation well nigh impossible.

The type of helmet invented by Mr. Spence has a pocket which holds a telephonic receiver, ear tabs and a flaring tube leading away from the pocket which connects with an opening inside of the ear tabs. When two or more persons are in the airplane each wears a helmet.



Trucks having six shel ves, each shelf capable of carrying seven telephone sets, are taken down on the elevator to the loading platform

Reducing Packing Costs in Handling Telephone Sets

THE tremendous cost of handling hundreds of thousands of telephone sets yearly in the factory has been greatly reduced through the use of small wheeled trucks, each carrying forty-two complete sets. Once a telephone set has been inspected and passed, it is not handled individually until it is taken from stock in a building several miles away.

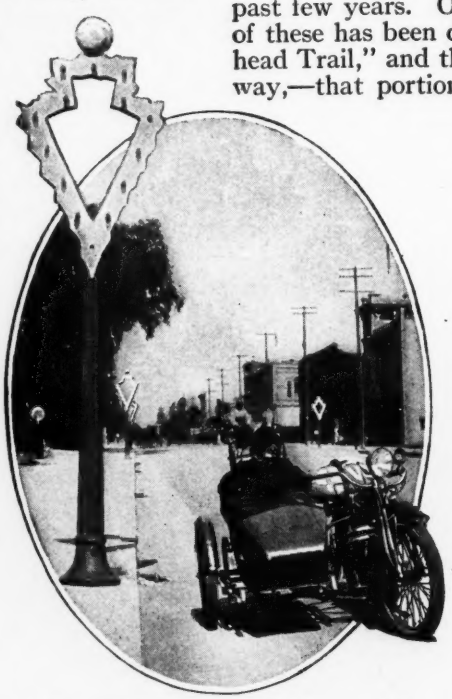
Before the trucks were introduced, sets were handled over and over again. They passed from the testing bench to an ordinary handtruck, from that into a motor truck, from the motor truck to another handtruck at the main storehouse and lastly from that to the stock shelf. Now the sets are handled twice only. They are placed on the trucks at the start and taken off at the end of several trips.

The trucks have six shelves each; seven sets are carried on each shelf. The truck is taken down on the elevator to the loading platform, where it is pushed into a large motor-truck capable of holding eight racks, or 336 telephone sets. At the other end of the route, the racks are removed in the reverse manner.

This method lessens the liability to damage; saves more than half of the former re-handling expense and enables the company to concentrate in one place all the packing activities from a number of buildings thereby reducing packing costs and the time usually required for the work.

Arrowhead Lamp Posts Mark the Arrowhead Trail

MANY motor routes have been opened up across the continent during the past few years. One of the most popular of these has been designated "The Arrowhead Trail," and the trail for a part of the way,—that portion which passes through San Bernardino, California,—has been "blazed" by lamp posts in arrowhead design.



The wooden arrowhead frame with seventeen lights was substituted for the old top of the lamp post

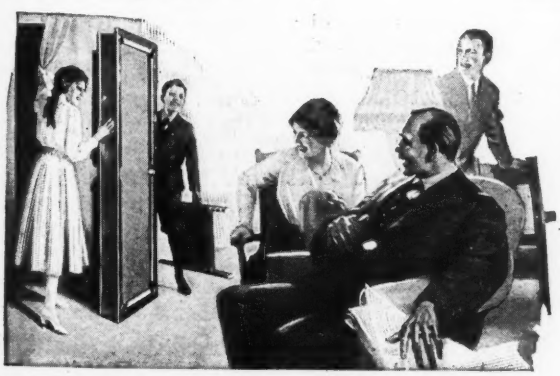
The arrowhead lamp posts were made simply by cutting off the top of the ordinary street lamp posts and substituting a wooden arrowhead, on top of which the regular electric lamp was placed. The arrowhead structure contains sixteen incandescent globes of a buff tint, to represent the rocks of the trail. These in conjunction with the large light at the top of the post make the trail brilliant through the streets of the city at night, advertising the route.

A Billiard Table that Folds Up to Be Stored Away When Not in Use

A GREAT many persons would like to play billiards at home but have no space for so large an article of furniture as a billiard table. A table has been devised which will allow such billiard lovers to gratify their desire for a game whenever they please.

The table is demountable and can be folded up and put in a closet when not in use. It is light enough to be handled with ease and may be set up ready for a game at a moment's notice.

The best feature of this new billiard table is that it has the necessary rigidity for scientific billiards. It has accurate angles, fast level beds and quick acting cushions. When the legs are unfolded in order to set the table up, they lock automatically so that there is no danger of the table wobbling when the game begins to grow exciting. Except that they are stronger and heavier, these legs resemble those of an ordinary folding sewing table.

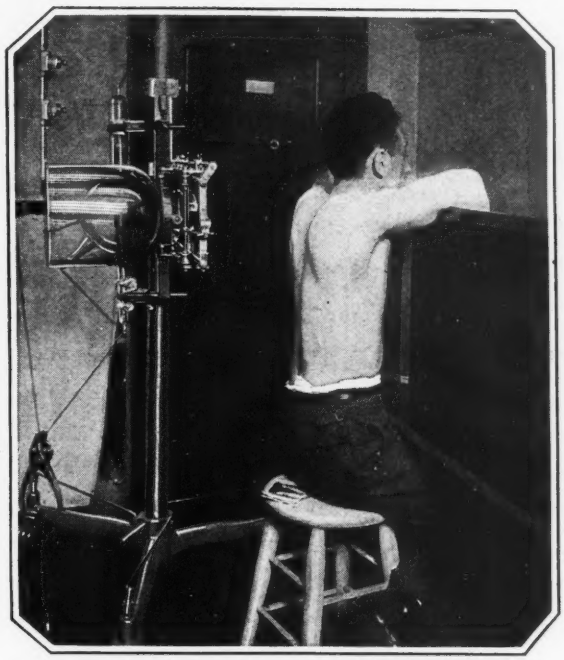


A demountable billiard table folded up. It may be set up for a game as easily as a checker board

Examining Recruits for Tuberculosis and Avoiding the Mistake France Made

AN American physician, Dr. Hermann M. Biggs, was sent to France by the Rockefeller Foundation to study health conditions among the soldiers. He found that France is a hot-bed of tuberculosis. When the war broke out there were in all France, only 1000 sanitorium beds for the treatment of tuberculosis, and no tuberculosis dispensaries at all. When France mobilized her great army she sent thousands of tubercular men into her trenches.

The United States Army officers are anxious not to make that mistake. They are, therefore, very particular about the examination of the recruits.



A recruit being photographed by the X-ray for indications of tuberculosis or lesion of the lungs

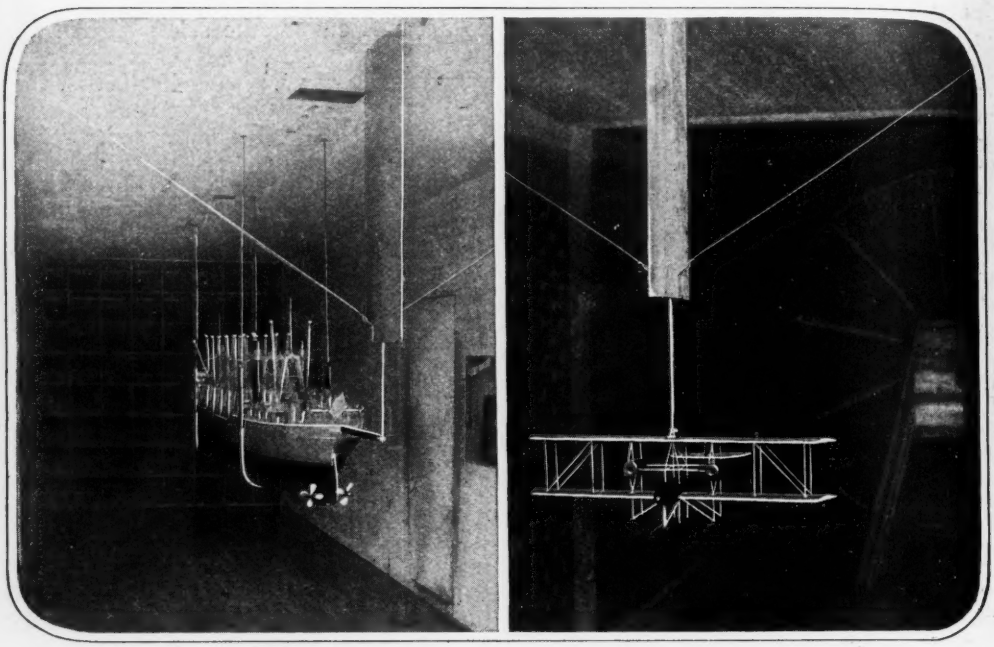
Sausage Made from Cottonseed—An Economical Tidbit

THE United States is certainly the "land of cotton." Nowhere else in the world is cotton grown in such abundance, and put to such a variety of uses. The fiber, of course, is made into cloth; the oil from the seeds is used as a good substitute for olive oil and as a basis for lard, and now the seeds themselves are being ground into flour and used for food purposes. Gingersnaps and jumbles are made from it, and it is mixed with finely chopped meat and tied in sausage links.

To make the cottonseed sausage, three pounds of sausage meat is mixed with one pound of cottonseed flour. This flour is said to contain as much nutrition as the meat which it takes the place of, and to effect a considerable saving on each pound of sausage.

Testing Airplanes in a Man-Made Storm

At the Washington Navy Yard a seventy-five-miles-an hour wind is shot against warships and airplanes to determine their air resistance



Because the tunnel is so large the models are made big enough to represent the actual machines faithfully in every particular. The wind attains a velocity of seventy-five-miles an hour

WHAT the model basin for towing small models of ships is to the naval architect, the windtunnel is to the aeronautica[1] engineer. In the past, ships developed good shapes through centuries of service only. A faulty design might prove slow, but rarely unsafe. On the other hand, faulty airplanes are death-traps, incapable of that continuous service from which experience grows.

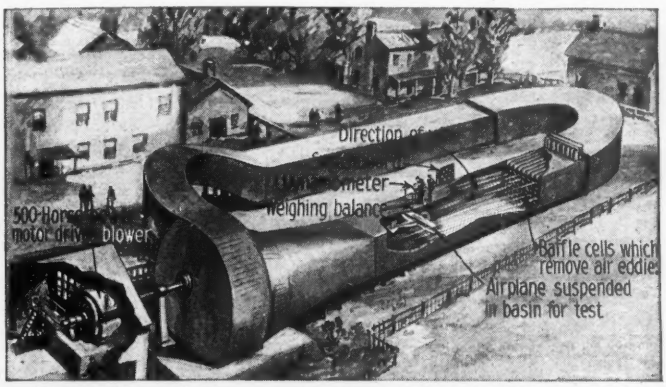
The invention of the airplane is due to the windtunnel. Models of wings were exposed to an artificial current of air and the force and direction of its pressure weighed. When the Wright Brothers found that they could not rely on previous experiments made on the airpressure of wings (the German pioneer, Lilienthal, had exposed them only to the irregular natural wind), they resorted to a primitive windtunnel. All early windtunnels were too small. They could not produce air currents fast enough; they were merely ventilating fans that forced fresh air continuously into a small passage. Nevertheless, we owe to them, such as they were, the modern fast and stable airplanes and the racing Zeppelin.

Nothing has so retarded aeronautic progress in America as the fact that work with Professor Zahm's pioneer windtunnel of 1903, at the Catholic University, Washington, D. C., was discontinued. For a decade, while Europe was waking up to the full importance of the subject, our country lacked this most necessary instrument.

The new windtunnel of the United States Navy is a model for the world. It is endless, forming a complete circle, or rather a circuit flattened into the shape of a chain-link. As there is no resistance against the motion of the air contained within a closed circuit, except its friction against the walls, and as the blower does not overcome the inertia of continuously renewed quantities of air, this arrangement gives the artificial wind a cross-section of eight feet and a velocity of seventy-five miles an hour. The artificial storm is produced by a blower of five hundred horsepower.

Because the tunnel is so large the models are made big enough to reproduce the actual

machines faithfully. The high speed of the wind is identical with the actual flying speed. Arrangements for slowing and accelerating the air, smoothing its flow, measuring its speed and impact, and eliminating resistance other than that offered by the object under test are provided.



The windtunnel forms a circuit flattened out like a chain link. There is practically no resistance to the blast of air

In such a tunnel the model to be tested does not move. It is rigidly fastened in place. Only the artificial wind moves. But the results obtained are exactly those that would follow if a full-sized model were made to fly in a wind of known strength.

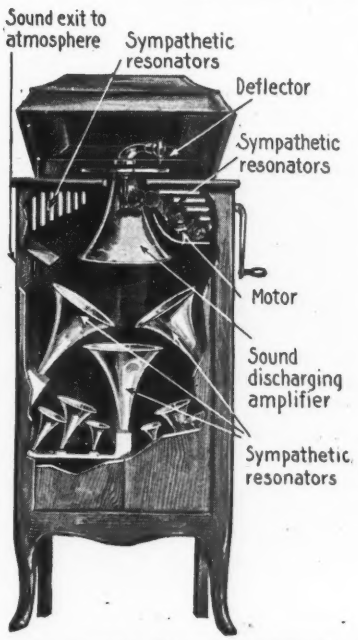
Not only have models of aircraft been tested, but the air-resistance of ships can now be ascertained.

Filtering Out the Harsh Tones from a Phonograph

A PHONOGRAPH cabinet calculated to sift, correct and beautify sound before it is thrown to the atmosphere, has been invented by Henry C. Miller of Saratoga, New York. The inventor's principal object is to correct the defects in some of the tones which are unduly magnified by the horn or amplifier. The operative principle of this cabinet will be better understood when it is made clear just how and where a tone is changed from true to false in your phonograph before it reaches the atmosphere.

Assuming all sound vibrations recorded in the grooves of the disk to be true and that they are now passing before the needle to be transmitted through the reproducer into the horn, it is noted that a certain tone is unduly magnified. If the horn is now substituted for one of a different volume and the record started over again, the defective tone will assume its proper value. But in so doing it will also be found that a different tone in the selection has been improperly reproduced. Why? Because the horn which serves to magnify all sound directed through it, is in itself tuned to a certain key by virtue of its size, shape and weight, and readily responds to vibrations of a tone to which it is keyed. Have you noticed that when a certain note on your piano is struck some object in the room vibrates with it in sympathy and produces a harsh effect? In a phonograph this sympathetic keying results often in undue amplification of an unimportant tone.

In this new cabinet the sound, instead of being directed from the horn to the atmosphere, is thrown downward into the open ends of a series of sympathizers and resonators, each carefully keyed to vibrate in sympathy with a different tone. It is, of course, necessary to provide enough sympathizers to correspond with every tone (sharp and flat) in the musical scale.



The sound is thrown downward upon carefully keyed resonators

When a record is played on this phonograph, each tone of the selection will set into vibration the particular amplifier which has been tuned to correspond with it. Thus every tone will receive equal amplification relatively to fit its original value before it is finally thrown on the air.

Above: The stairway closed. At right: The stairway lowered. The pulleys are fastened to rafters in the attic

Want to Go to the Attic? Just Pull Down the Stairs

IN a house in which every inch of space was utilized to advantage, a novel plan was worked out to reach the attic. In fact, no stairway was provided, so far as eye could see. But the ceiling in the hallway of the second story had an unusual panel with a brass handle at one end.

If you desired to visit the attic the secret would soon be made clear. You would simply be advised to take a curved-handled cane which stood in the corner nearby, hook it into the brass handle in the panel, and then pull down on it. Immediately the panel would be lowered and you would find on the upper side a ladder-like stairway leading directly into the attic.

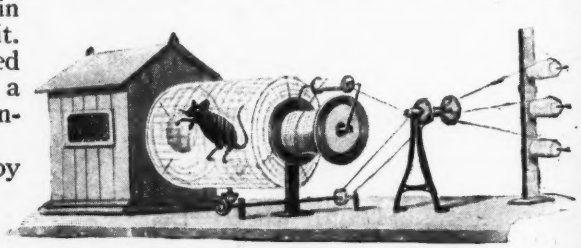
The panel-stairway is operated by a pulley attached to the rafters in the attic and to the inner side of the panel, as shown in the illustration above. The arrangement was found desirable in this case because the attic was used only occasionally.

Something New in Industry—A Mouse Spins Cotton Thread

A THRIFTY Scotchman, David Hutton, conceived the idea of using mouse power commercially. He experimented with mice and found that a mouse will run on an average of ten and one half miles a day. One mouse in Mr. Hutton's collection actually ran eighteen miles in one day. The power of a mouse is not much when compared to horse power; yet it is enough to spin cotton thread.

The cost of mouse upkeep is not very high. One mouse was kept in fine working condition for thirty-five days on one-half penny's worth of oatmeal. During those thirty-five days that mouse ran three hundred and sixty-two miles. Mr. Hutton built a thread mill for his mice which was so constructed that the mouse was able to twist, and reel from one hundred to two hundred and twenty threads a day. The mouse ran ten and a half miles every other day. Two mice were kept constantly engaged in the spinning of thread for more than a year.

In five weeks, on a half-penny's worth of oatmeal, one mouse spun three thousand, three hundred and fifty threads, twenty-five inches long. Counting the earnings of the mouse at the rate paid to women for making thread, it was found that the mouse earned nine pence every six weeks. After deducting the yearly cost of the mouse's rations and the wear on machinery, the profits from the mouse were about a dollar and a half.



A spinning mill designed to utilize the now wasted mouse power of the world. A mouse operating the machinery can spin three thousand, three hundred and fifty threads, twenty-five inches long, in five weeks

A Telephone Conversation May Be Almost "Private" Nowadays

A SILENCER which is easily attached to the ordinary telephone makes it possible to talk into the transmitter without being overheard by any one in the same room.

The silencer is provided with a tube and a diaphragm to increase the vibrations. This is so effective that even a whisper may be heard. At the speaking end is a pliable rubber mouthpiece that fits closely over the lips. Sanitary mouthpieces for the purpose come in nests so that frequent changes are possible.

The mouthpiece entirely incloses the mouth so that no sounds escape

Another Biggest Thing in the World—This Time a Riveting Machine

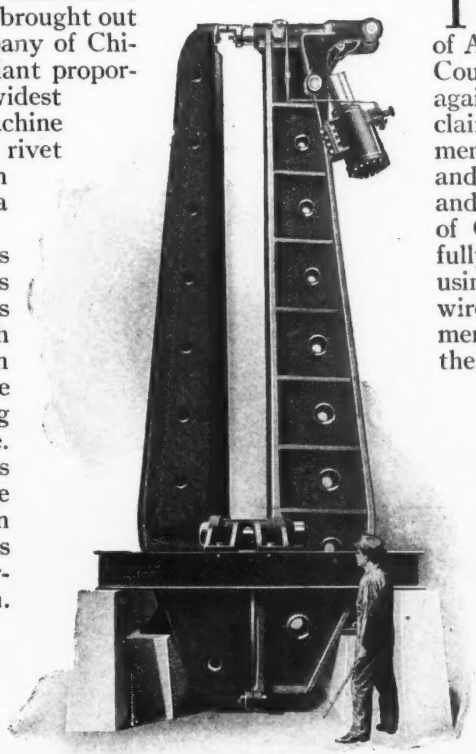
THE largest riveting machine in the world has been brought out by an engineering company of Chicago. Aside from its giant proportions (it will take the widest girder ever made) the machine is capable of driving a rivet home with blows each exerting a pressure of a hundred tons.

The machine is mounted vertically. This enables a pair of girders to be fed through with the greatest facility. An overhead traveling crane carries two overlapping plates into the machine. The vertical line of bolts which are to join the plates together are then riveted one by one as the crane moves the girders either up or down.

The pressure exerted upon the bolt heads makes the seam steamtight. Compressed air under a pressure of a hundred pounds to the square inch is admitted to the piston cylinder. Every square inch of piston area gives a hundred-pound push to the piston rod. Since the resulting force is again multiplied by levers on the top of the riveter, it is no wonder that so mighty a pressure is obtained.

The "reach" of the machine is twenty-one feet. By turning the pair of plates around, therefore, girders over forty feet wide can be joined.

The reenforcing of the joints of this riveter was something of a problem. The tension at the base joint amounts to nearly three hundred tons. The heavy toggle joint shown, however, withstands even this tremendous pressure.

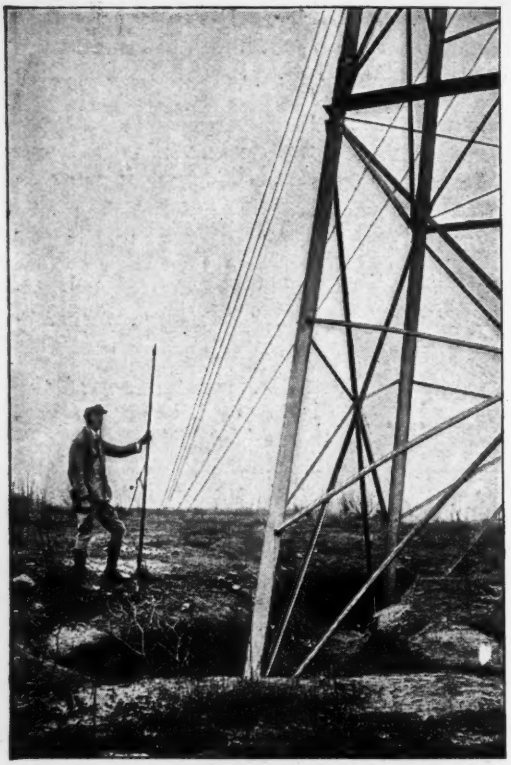


The giant riveter which does its work at one hundred pounds pressure

The Marconi Company Sues the U. S. Government for $1,000,000

THE Marconi Wireless Telegraph Company of America has filed in the Court of Claims a petition against the United States, claiming that the Government, through the War and Navy Departments, and also the Department of Commerce, has unlawfully been constructing and using since June 25, 1910, wireless telegraph instruments which infringe upon their patents. Some of the patents involved date back to the beginning of practical wireless telegraphy. The Marconi Company charges that the damage amounts to a million dollars, and accordingly, is suing the Government for that prodigious sum.

Interest in the case is increased by the multiplied uses to which wireless apparatus is being put at this particular time.



For the antenna and ground for his wireless the lineman uses a pole with metal end-caps which are connected with the receivers

Detecting Defective Insulators While Standing on the Ground

LINEMEN usually climb transmission towers to find defective insulators. T. F. Johnson, of Georgia, has a device which will detect leaking insulators without the tower.

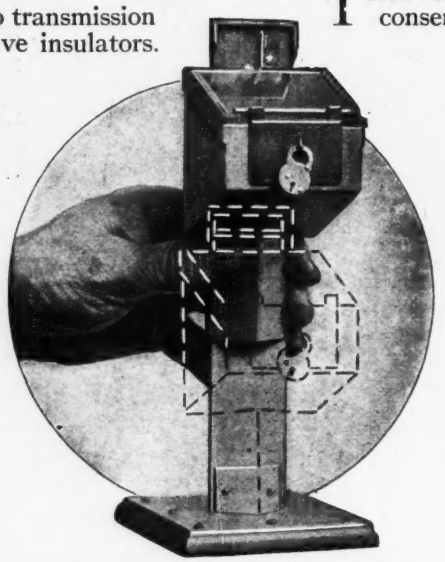
The invention employs the same type of instruments that are used in wireless telephony. In the transmission of high tension alternating current, when electricity breaks through an insulator, little wireless waves are sent off. The inspector, therefore, simply carries a wireless receiving set with him. A decided buzzing in his receivers is a sure sign of trouble in the wires.

We Use Eighteen Times as Much Light as Did Our Grandfathers

DR. WALTER CLARK, of Philadelphia, has recently made some interesting investigations to find out how the old-time lighting conditions in his city compare with those of to-day. He has discovered that until as late as 1855, only flickering sperm oil and candles were in use. Not until the following decade did the "highly improved" kerosene lamp appear. Gas did not come out until the period between 1865 and 1875. And then only the wealthy could use it. It sold at $2.50 per thousand cubic feet! The efficient Welsbach mantle came out ten years later, revolutionizing artificial illumination. The present era began in 1895, when gas and electricity came into general use—gas selling at $1.00 per thousand cubic feet and electricity at ten cents per kilowatt-hour. Since this time the gas mantle and the electric filament have seen vast improvements, so that to-day the average family is obtaining about eighteen times as much light as the people of half a century ago had, though they pay only about three-quarters as much for it as their grandfathers did for the dim lights of other days.

Matches? Take One At a Time, If You Please

THIS counter match safe is a conserver of matches as well as a dispenser. It is so arranged that not more than one match is delivered at a time unless the safe is unlocked for the purpose. A small hook at each side of the carrier grasps one match, which is lifted when the operator raises the box from its normal position and lets it fall back into place. A small projection on the standard dislodges the match from its holder as it rises above the rear part of the glass cover. The match rolls down the sloping glass and rests within easy reach of the customer.

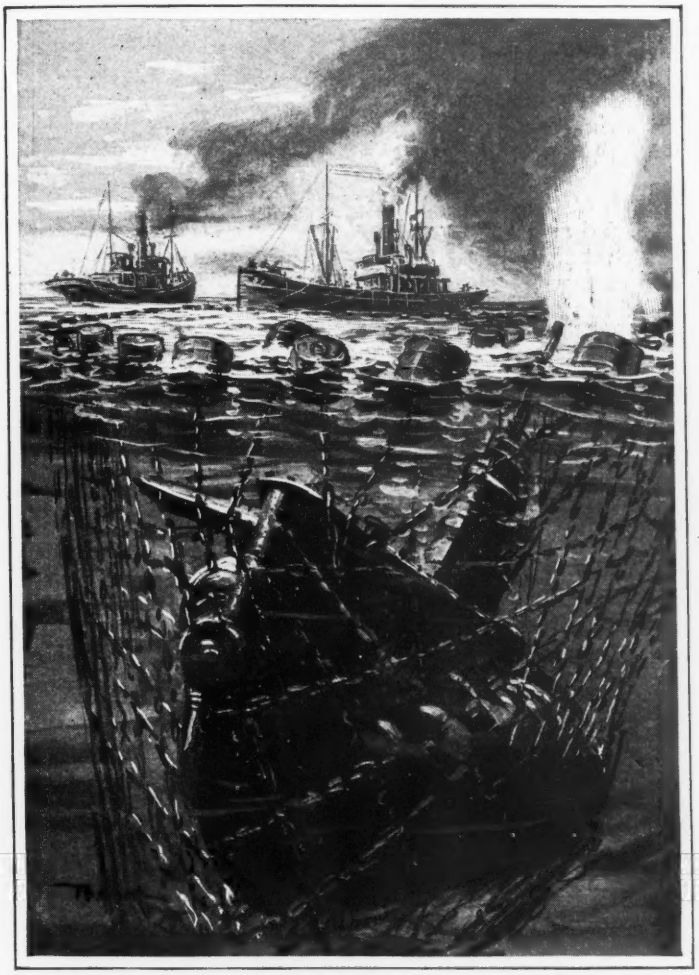


When the match safe is raised to its highest position a match is dropped down on the glass cover and rests within easy reach

England's Great Under-Sea Wall of Bombs

A combination of nets, bombs and patrol boats affords protection from the most daring submarine

STRETCHED across the Straits of Dover, to guard the English Channel, and strung opposite many other strategic points around the coasts of England are hundreds upon hundreds of miles of explosive raid-preventing nets. These silent, lifeless contraptions of bombs and cables are nevertheless the most vigilant watchers of the sea. German torpedo boat destroyers and even submarines may steal past British patrol boats. But if they get through the nets, it can only be said that a miracle has happened.



German torpedo boats and submarines may steal past England's patrol boats. Through her nets, however, they cannot go

England, after three years of experience has made the nets too foolproof for that. A special rust-resisting cable is suspended from an uninterrupted line of buoys. The buoys are merely steel barrels made water tight. Directly below each barrel is a corresponding anchor to keep the nets vertical and taut at all times. At every few intersections of the net cables, the high-explosive bombs are placed. The slightest jarring of the net by an intruder will set off the bombs held in the adjacent meshes. Against the resulting explosion the intruder has not a chance. At least once a week, more often twice and sometimes three times in a week, an explosion is heard at the "barriers," as the lines of nets are called, which announces that an enemy vessel has gone down in its attempt to break through.

What is especially significant about these nets is that they work as well at night as during the day. Here, again, they have an advantage over the patrol boats. Nevertheless the patrol boats must guard the nets and see that neither enemy airplanes nor torpedo boats have a chance to sink the steel buoys. The combination of nets and patrol boats forms a practically invulnerable protecting wall, which is never allowed to become broken or disarrayed.

Repair boats are constantly making needful patches, and are ready to renew even an entire section of a net should that be necessary at any time of the night or day.

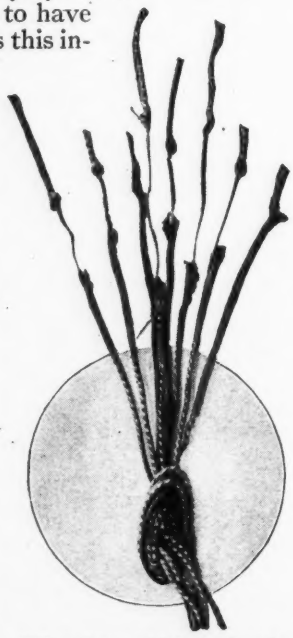
Consider the Rat

The most destructive mammal that lives with man. It costs $200,000,000 to keep our rat population every year

By Fred Telford

RATS probably destroy more property than any other mammal. They are a luxury hard to support. A little incident reported by Edward Howe Forbush, Massachusetts state ornithologist, in his booklet "Rats and Rat Riddance," illustrates the prevailing ignorance with regard to the depredations of this unconscionable pest.

A grocer in a Massachusetts town complained to his landlord of the injury to his stock caused by rats, and asked to have the building made rat-proof. As this involved considerable changes, the landlord proposed that he pay the amount of the damages instead. When he was presented with a bill for $25 at the end of the first month, however, he refused to believe that the damage was really so great until shown the ruined goods. Then he decided it was cheaper to make the building rat-proof. When this was done and the rats in the building destroyed by phosphorus, the depredations ceased.



Wires from which the insulation has been gnawed by rats

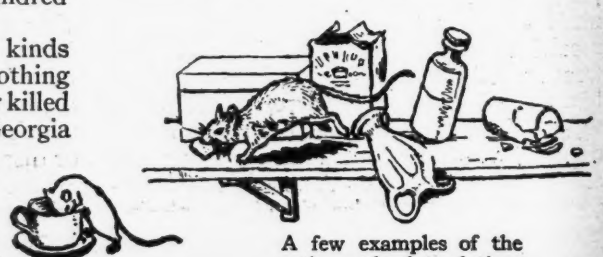
Just at present the damage done by rats is particularly serious because their principal food is grain and grain products. Corn is eaten both in the field in the shock, and in the crib. Wheat if not actually consumed is rendered unfit for the table or manger. An Iowa farmer had such a numerous colony of rats that they destroyed one-fourth of the corn in two cribs containing two thousand bushels. He killed as many as one hundred and fifty rats a day.

The rat population of farms of all kinds where grain for food is abundant is nothing less than startling. An Illinois farmer killed 3,435 rats on his farm, while on two Georgia rice plantations it was estimated that forty-seven thousand rats were killed during the spring and summer of one year. A rat hunt in Ohio, with sides chosen, yielded over eight thousand rats. Many ships also have a big rat population; when the steamer Minnehaha was fumigated at London some years ago seventeen hundred rats were killed.

100,000,000 Is Our Rat Population

The most reliable estimates of our rat population are based upon the figures obtained in the rat-killing campaigns instituted when the bubonic plague, a rat-borne disease, invaded the United States a few years ago. In the first four months of the campaign about 130,000 rats were killed in San Francisco; up to May, 1908, 278,000 were actually captured, and probably 500,000 poisoned. The most careful estimates place our rat population at 100,000,000, or about a rat per person.

The direct cost of maintaining this enormous rat population mounts into large figures. David E. Lantz, assistant biologist for the United States department of Agriculture, several years ago estimated that the cost of feeding a rat on grain was from 60 cents to $2 a



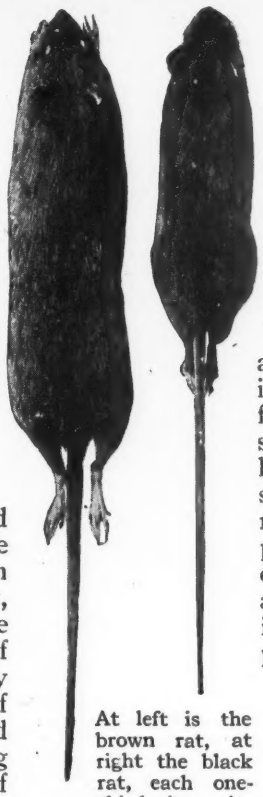
A few examples of the rat's costly depredations

year, and that on a farm at least 50 cents more was wasted; he believed that in a city the damage is greater. Hotel managers and restaurant keepers put the cost of keeping a rat at $5 a year or even higher.

These figures were reasonable before the war sent prices soaring. Now they are far too low.

The Rat Is an International Problem

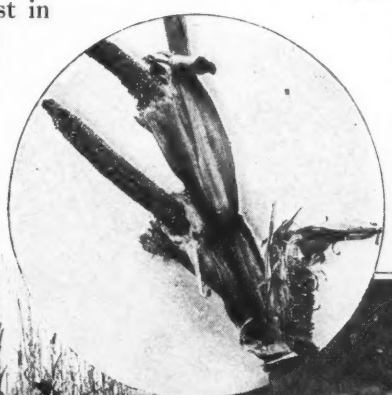
It would be tedious to enumerate the different ways in which rats cause direct or indirect loss. Some of them are injury to furniture and clothing, destruction of valuable papers, stripping labels from canned goods, hiding jewelry, destruction of poultry, and the catching and destruction of hatchings in fisheries. They even gnaw into the hoofs of horses until the feet bleed, and have been known to kill young pigs and lambs. The variety of articles carried away for nest building is shown by a nest in which were found bits from three bedroom towels, two table napkins, five dust cloths, two pairs of knickerbockers, six linen handkerchiefs, and one silk handkerchief. Near the same nest were stored one and a half pounds of sugar, a pudding, a stalk of celery, a beet, carrots, turnips, and potatoes.



At left is the brown rat, at right the black rat, each one-third its size

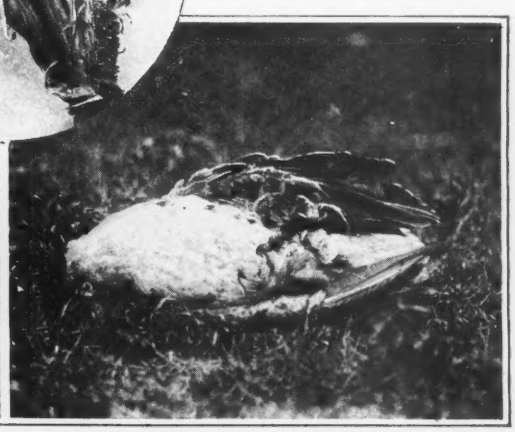
Another count against the rat is the spreading of disease germs. The bubonic plague is spread almost entirely by a rat-borne flea. Trichinosis is also spread by rats. As the rodents are frequenters of drains, privies, and sewers in their search for food, they spread ptomaines. In slums, where they are present in large numbers, they are a factor in spreading highly contagious and malignant diseases. Owing to their prevalence on ships, they carry disease from seaport to seaport, and are a menace to be considered in the international control of the world's plagues.

The rat that is most common and most troublesome in the United States is the brown rat. The black rat, formerly abundant in the eastern part of the country, is now rare in the United States; it was introduced earlier than the brown rat, but seems to be unable to hold its own here successfully.



At left: A single corn stalk showing how completely the rats stripped the corn-cobs of grain

An entire cornfield devastated by rats, which climbed the stalks, tore off the husks and ate the grain, leaving only the cobs



The carcass of a young Canada goose, killed like hundreds of others by a rat which gnawed off the head and drank the blood

Tree-branches on which skulls of animals are placed, are set at strategic points to keep evil spirits away from date palms

Eat Your Dates with an Easy Mind. They are Protected from the Evil Eye

THE Arab date-grower worries about the Evil Eye more than about anything else in growing dates. If the Evil Eye can be kept from bewitching the palms the date crop will be large and the owner prosperous.

So he looks over his garden and selects strategic points where he plants branches of trees on which he places the skulls of goats, sheep or horses. While these grim bones stand guard over the garden it is utterly impossible for anyone to cast a spell on it. That is why, according to Arab lore, some date-growers have so much larger crops than others. They know at just what angle of approach to plant the spell-breaking skulls.

Removing Disfiguring Scars by Electricity

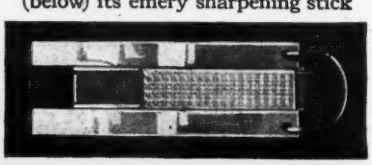
AS the war progresses, the means employed for treating the wounds of the soldiers become more and more numerous. A new application of electricity is one of the latest treatments for removing disfiguring scars, straightening out shriveled muscles and making a man his own handsome self again, however badly he may have been wounded. In the French method, the electrode connected with the negative terminal of the battery is applied directly to the scar. The electrode is covered by a thin sheet of sterilized asbestos. This is soaked in a suitable caustic solution before the application. The remaining positive electrode is placed on the other side of the limb, directly opposite the wound. Then when the current courses through, the color of the scar slowly begins to fade, the skin begins to soften, and the scar to thin out once again. After a few months' treatment of at least one hour each day, all but the most obstinate scars will have disappeared.

Sharpening Your Pencil Without Soiling Your Fingers

HERE is something which will appeal to youngsters as well as to grown-ups—a pencil sharpener which will not sharpen the pencil all away before it makes a point and which will not leave the fingers smudgy.

The principal feature of the sharpener is a sliding block whose position determines the degree of sharpness of the pencil. This movable block contains an emery sharpening stick which may be easily removed for the purpose of sharpening the cutting blade whenever this becomes necessary. The sharpener is flat so that it may be carried in the pocket or in the leather pencil cases now becoming so popular among the school children.

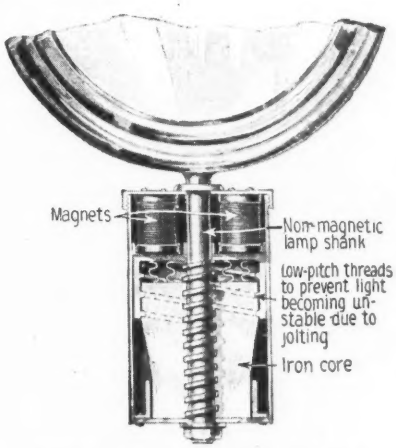
The pencil-sharpener in use and (below) its emery sharpening stick



A Turn in the Road? Swing the Headlights Electromagnetically

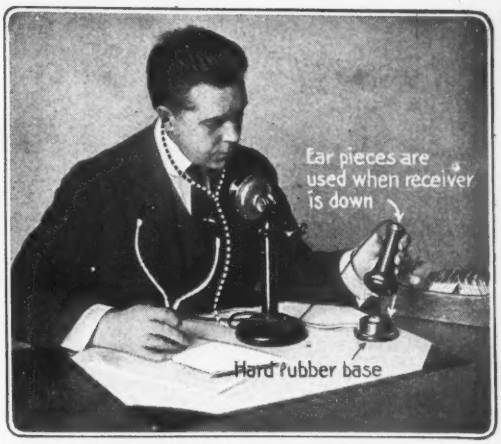
A NEW electromagnetic device for automatically turning the headlights of an automobile so that the rays of light will follow the wheels instead of being thrown straight ahead while the car is turning a corner has been patented by a Mississippi inventor. The device may be connected up to work in conjunction with the steering apparatus or be manipulated by hand through an electric switch to vary the amount of current sent through the electromagnets and thereby vary the angle at which the lights are turned.

Each headlight is carried in a yoke at the top of a vertical shank made of non-magnetic material and inserted at the center of a hollow cylindrical case. The shank is rigidly attached to the case by a washer at the top and a nut at the bottom. The lower portion of the vertical lamp shank is threaded to mesh with the threads cut on the surface of a vertical hole of a cast-iron core carried in the bottom of the cylindrical case. This core is square-ended at the bottom and retained in an enveloping L-shaped bracket on the bottom of the case. At the top it is provided with two springs attached to an inverted cup-shaped collar of slightly less diameter than the main case. The energization of the magnets, which are carried in the top of the case, causes them to make the iron core move upward, since it cannot revolve because its end is held in brackets. Since the lamp shank cannot move upward, it is caused to revolve, turning the light with it in direct proportion to the lift of the iron core and the amount of current used. Springs between the top of the core and the cup-shaped collar and threads of little pitch on the inside of the collar and the top of the core prevent the light from becoming unstable through the jolting of the vehicle over rough roads.



Each headlight is carried in a yoke at the top of a vertical shaft made of non-magnetic material

This swinging of the headlights protects the tires from puncture by lighting up the road in all directions.



The ordinary telephone receiver is placed over a base which carries the sound to the Y-shaped tube

Must You Telephone a Secret? Whisper Into This Device

WHILE a telephone booth shuts out all disturbing sounds, it cannot increase the power of the voice projected from the receiver. Both of these desirable objects are accomplished by means of the new device shown in the accompanying illustration.

The device is in reality two receivers instead of one, and yet the conventional receiver is not used directly but merely as a medium to transmit the sound to both ears. The instrument consists of a small base of hard rubber with a felt bottom. From this base a Y-ended tube with hard rubber ear pieces on the ends of the Y is employed to carry the sound to both ears at once, thereby doubling the volume of the sound. A flexible wire inside the tube serves to carry the sound waves and to keep the contour of the ear pieces so that they will not drop off.

Experience has proved conclusively that most of the confusion of sounds encountered in telephoning is due to the fact that only one ear is used in listening. The other ear is receiving other sound waves from the room. This is not true with this device.

Forty-Five Miles an Hour on This Motorcycle Sleigh

WHILE all the automobiles and other vehicles in his neighborhood were stalled on account of the snow, Clarence H. Lydamore, of Lake Placid in the Adirondacks, was hard at work planning to convert his motorcycle into a powerful motor-sled. The result was that soon he was successfully riding into town on business trips, and was sleighing on the lake for pleasure while the other cars were rusting in their garages.

The motor-sled, devised from a motorcycle frame and a sidecar, makes forty-five miles an hour

The conversion was simple enough. The front wheel was removed and the sleigh runner shown in the photograph was put in its place. A sidecar, also mounted upon a runner, was attached to the motorcycle framework. This served the double purpose of providing for another passenger and of preventing the new sleigh from tipping should it skid on the ice or snow.

On attaching extra heavy anti-skid chains to the driving wheel, the sled was ready for work or play. Over the roads, a speed of forty-five miles per hour has been attained on it. Over the lake, with the assistance of the wind, a party of four has almost doubled this speed.

Hot Water in an Instant Is Promised by This Heater

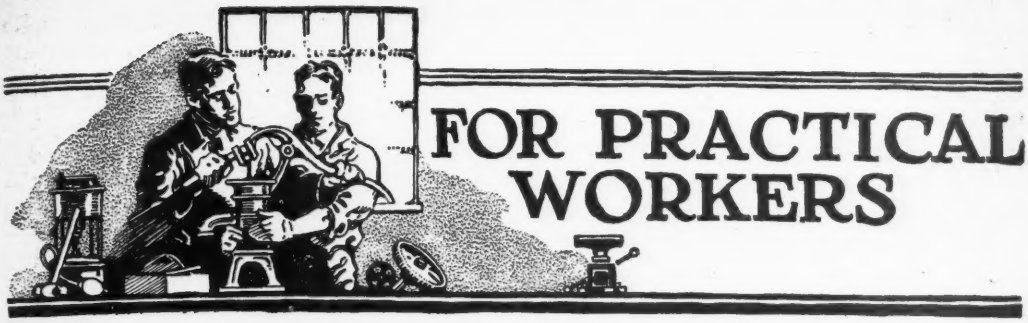
THERE is a new hot-water heater on the market which comes as near to being "instantaneous" as it seems possible for a heater to be. So cleverly is it constructed that you can draw as much heated water as you want to use without any appreciable "wait" between the pailfuls that you draw.

The body of the heater is placed just below your kitchen boiler. It consists of a large globe of comparatively thin iron and a large gas burner secured just below this. A two-way pipe connects the boiler with the globe so that the water can flow as easily from the boiler to the globe, as in the other direction. An auxiliary tap connects the bottom of the globe with a faucet. This addition is the principal improvement which makes the heater different from others. No sooner has the water in the bottom of the globe become heated than you draw it off through the faucet, if you desire.

You do not have to wait for the heated water to permeate slowly upward to the top of the boiler, as with the ordinary heater. Not that you can't use this arrangement as an ordinary heater, too; for if you wish a whole boilerful of hot water, you simply let enough of the water which is being heated in the globe rise through the two-way pipe.

You could then tap the water off through the faucet at your sink, or from any of the faucets connected with the piping from the boiler, instead of drawing it off by the pailful from the faucet at the bottom of the heater.

In a few seconds after the gas is lighted the water in the iron globe is hot and can be drawn off



FOR PRACTICAL WORKERS

Chemical Flasks Made from Electric Light Bulbs

CHEMICAL flasks are indispensable around the laboratory. Very serviceable ones can be made, at practically no expense, from worn-out electric bulbs. Since the bulbs are manufactured in various sizes, it is possible to construct flasks of many dimensions according to the sizes of the electric globes.

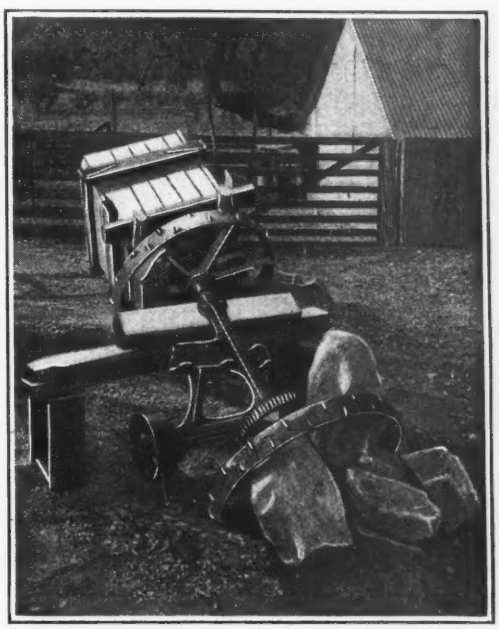
The essential materials are a Bunsen burner and a three-cornered file. If a Bunsen burner is not available, any burner giving a hot blue flame can be utilized instead. Hold the brass base of the bulb in the flame for a few seconds, until the cement surrounding the glass has melted sufficiently to enable you to pry the base off with the pointed end of the file. Allow the glass to cool; then with warm water clean off the cement that still adheres to the bulb.

Carefully make a scratch with the file around the circumference of the bulb where the globe proper is sealed to the filament. A light blow will separate the filament from the bulb. If the mouth is left rough, it may be smoothed by revolving it in the flame. While the bulb is soft at its mouth, it may have a small taper put on it with the sharp end of the file. When it has cooled, hold the mouth of the flask in a cloth, and permit the large end to revolve in the flame, taking care to heat the glass evenly until it softens. Have a clean dry slab of marble, slate or similar substance at hand, and press the flask down on it evenly so that the flask can stand by itself.

After a few flasks have been completed, they should be placed in a strong salt solution. Heat the solution, while the flasks are in it, bringing it gradually to boiling point; then when the brine has cooled, take the flasks out. They are then ready for use.—HERMAN NEUHAUS.

A Concrete Mixer Made Out of an Old Mower

AN old dismantled mower constituted the foundation for this unique concrete mixer. One mower wheel was planted in the ground and weighted with rocks, while the other was supported on a beam to stand the axle at an angle. The sickle driver head was removed and a band wheel put in its place. A rough wood box constructed of matched lumber to make it water-tight was fastened to the spokes of the upper wheel. A hinged cover was fastened to the open end. In this the cement was whirled.

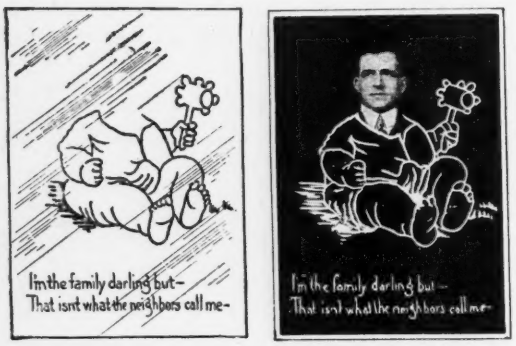


The axle of an old mower set at an angle and used to revolve a box for mixing concrete

A portable farm engine was used for the power, which was connected up to the mixer with a belt.—J. E. GRINSTEAD.

Comic Photographs Made With Film Negatives

SOME very interesting and simple comic pictures can be made with old films and film negatives in the following manner.


I'm the family darling but—
That isn't what the neighbors call me-
I'm the family darling but—
That isn't what the neighbors call me-

The pen and ink picture drawn on plain film and the finished comic photograph

The pen and ink part of the picture is drawn upon an old film that has been thoroughly cleaned. This comic part may be drawn in free hand with India ink.

The head and shoulder part of a portrait film is cut out on the outlines of the figures and pasted on the comic film. These are printed in the same manner as other negatives.—C. BUSH.

Testing the Strength of Norway Iron While Hot and Cold

IRON made in Norway owes its fine qualities to the exceptional purity of the ores from which it is made, and the care taken in its manufacture. The smelting is done with charcoal. The metal has a purity of 99.8 per cent of iron, the remainder being sulphur, slag, carbon, silicon, manganese and phosphorus. This iron is very low in sulphur and phosphorus, the two ingredients which modern manufacturers strive to keep as low as possible in their product.

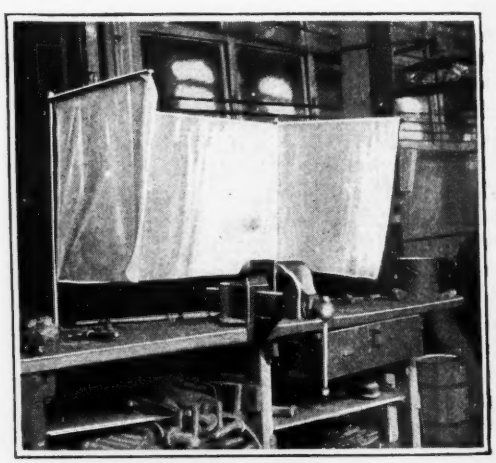
Sulphur makes iron brittle when hot, thus causing it to break in the rolls. Phosphorus, on the other hand, makes iron brittle when cold and interferes with its strength and ductility in bending. Norway iron, on account of its exceptional purity, has come to be recognized as the world's standard, to which the quality of all other irons is compared.

A round bar of Norway iron will stand the severest cold bending test. You can bend and hammer it back on itself, and then bend and hammer it at a right angle to its previous position so that one part is touching another. The iron will show no signs of cracking at the bends. One bar of this metal was tied into a knot while hot, and showed no signs of cracking at the bends. Cracking at the bends when the iron is hot is due to sulphur. When pulled apart in a testing machine, this iron showed a very fibrous fracture. Steel made from Norway iron by the crucible process makes the finest kinds of razors, tools, etc., which keep their edges sharp for a long time. It is a metal that can be depended upon in every respect.—W. S. STANDIFORD.

A Protection Curtain for a Mechanic's Work Bench

IN a large railway shop heavy cloth screens are provided on the work benches around devices which are used by metal workers, especially in cases where babbitt or other soft metal is removed from armatures. This protects passing workmen or bystanders from flying pieces of metal. The curtain also tends to confine the chips to the bench and keep them from littering the surrounding floor space.

The curtain is extended on a frame made from two upright round iron bars, connected by another iron bar. From this connecting bar rods extend which are of sufficient length to carry the curtain across the bench.

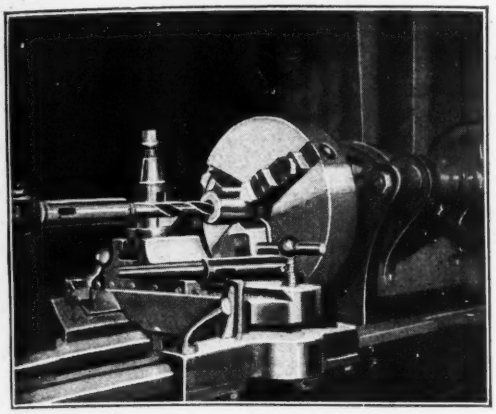


Protecting passing workmen or bystanders from flying pieces of chipped metal

This is an inexpensive but effective arrangement for the purpose and could easily be adopted for other uses of a similar nature.—RALPH O. MCGRAW.

Drill Holder for the Tailstock of a Lathe

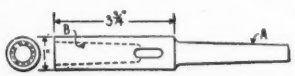
THE drill holder illustrated was designed to comply with a law enforced in many states which demands that a drill must be



A drill chuck for the lathe center that provides a holding device without projections

firmly held in a chuck or other suitable device without projections when used on work held in the chuck or fastened to a faceplate of a lathe. An efficient chuck is shown above, in use in a lathe.

The holder is made of machine steel, the shank *A* being turned on a taper to fit in the tailstock. The socket *B* is bored to fit the Morse taper. This taper in No. 2 will take all drills up to and including 29/32 in., and is best suited for small lathes. A No. 3 taper is better for lathes of 14-in. swing or larger.—HARVEY MEAD.



Details and dimensions for the lathe drill holder

Some Useful Hints for the Owner of a Phonograph

IF the spring rubs or jumps when the phonograph is playing it is a sign there is a dry spot somewhere between the leaves. Wind it up fairly tight and let it run completely down two or three times. This will open up the leaves and distribute the grease between them.

Phonographs equipped with metal horns can be much improved in tone and the metallic effect killed by wrapping the horn with electricians' or tire tape.

Camels' hair brushes are of little use in cleaning disk records. Glue a piece of clean Brussel's carpet to a block of wood and rub the record well with a circular motion. This removes grit and dirt that the brush might pass over and does not injure the record in the least.

The troublesome vibration occurring in many machines can be remedied by inserting felt between all joints in the cabinet and where the motor touches the wood.

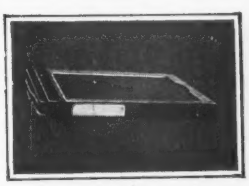
Loud needles can be made to play as soft as desired if they are inserted only part way in the holder.

Coating for Window Glass to Keep Off the Frost

FIRST clean the panes thoroughly and wipe them dry. Dissolve 1 oz. of glycerine in a pint of alcohol, (denatured alcohol will answer the purpose) and add a little amber oil to improve the odor. Let the solution stand until it clears, then rub it over the inside of the window panes with chamois or a hard cloth. This treatment of the windows in cold weather is inexpensive and often reduces complaints about insufficient heating made by storekeepers whose grievance is founded only on the obscuring of their show windows.—PETER J. M. CLUTE.

Instruction-Marker Plate for Photographic Plate Holders

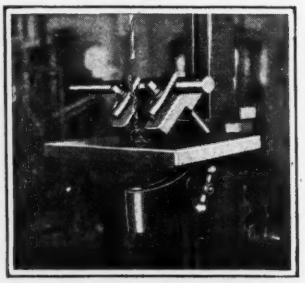
A GREAT many amateur photographers who have their exposures finished at a studio frequently have their instructions misunderstood as to how many prints are wanted and when. The illustration shows how a thin strip of celluloid on which any information can be written can be glued to the side of the holder. On the majority of cameras using or accommodating plates, this does not interfere with the entrance of the holder into the slide at the rear. The upper side of the strip can be slightly pointed as shown, toward the side of the holder to which the information refers. The other strip would of course be inverted. Use a good grade of glue so that the small thin strips will adhere permanently. Any kind of light celluloid has sufficient grit for a lead pencil to make a perfectly legible mark on it.

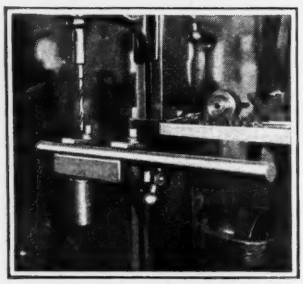


Instruction-marker plate for plateholder

V-Block With Clamps for Small Drill Press

THE V-block shown in the accompanying drawing and photographs is a very handy tool on the drill press. It is especially useful when one has small round pieces to be drilled. The work may be held securely and the holes drilled accurately.

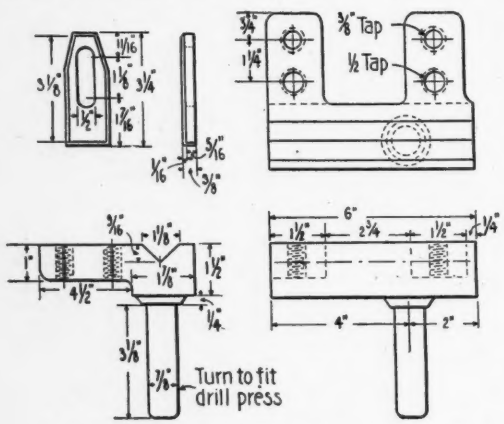




The clamp and how it is used in a drill press

The clamps, of which there are two, are designed so that a wide or narrow bearing on the work may be had. This is shown in the photographs. The screw in the back regulates the level of the clamp and the other draws the clamp down into contact with the work.

The post is turned to fit the lower table bracket of the drill press. The center of the V is in line then with the center line of

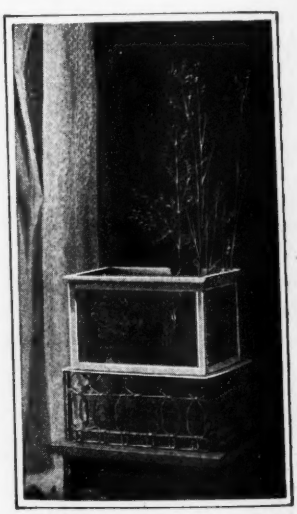


Detailed dimensions of the V-block clamp for use in a drill post for drilling round stock

the spindle, and the holes drilled in work will pass through the center. To prevent small drills from running off center a guide may be bolted down on the clamp.

The Balanced Aquarium for the Proper Care of Fish

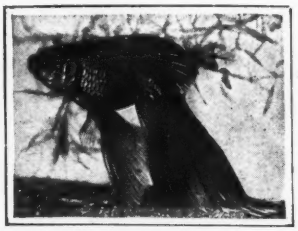
IT has only been made possible to produce a naturally balanced aquarium since science has progressed far enough to establish the conditions under which aquatic plants and animals live. All living things require oxygen. Oxygen is breathed in and carbon dioxide is given off. All aquatic animals use only that oxygen which has been dissolved and mixed with the water, and give in return carbon dioxide. During the day all green plants use carbon dioxide and give oxygen off as waste matter. But at night this process is reversed; that is to say, at night the plant uses the oxygen for inspiration and gives off carbon dioxide. This is easily proved by an interesting experiment. Isolate an aquatic plant with a certain amount of air. A few days later the volume and composition of the inclosed air will still be constant. But if carbon dioxide be added to the inclosed air during the day an analysis will later show that the oxygen is predominant. In a balanced aquarium the plants use up the carbon dioxide during the day which has been given off to the water, and in return they give off oxygen. One plant can use only a certain amount of carbon dioxide during the day and give off a certain amount of oxygen. For this reason the number of plants in an aquarium should exceed the number of fish it contains to prevent the accumulation of carbon dioxide in the water and to assure an abundant supply of oxygen.



Plants in an aquarium to make it properly balanced

If there are no plants in an aquarium the water must be changed regularly to keep it pure and healthful for the fish. A balanced aquarium, containing both plants and fish, keeps the water fresh, pure and healthful for the fish and only that part of the water need be replaced which has evaporated.

One requirement of a balanced aquarium is a rich alluvial soil in which the plants may flourish. A few rootless aquatic plants, as *Fontinalis* or *Ceratophyllum*, grow in clean sand. The best soil for the aquarium is a mixture of top soil loam and sand. Before placing the soil in the aquarium, a small piece of glass should be puttied in one corner. On this all refuse will accumulate so it can be easily removed. Arrange the soil in the aquarium so that it slopes gently toward the refuse corner. The highest part of the soil is placed diagonally opposite it. Place marsh plants in the highest part. Of all marsh plants *Cyperus Alternifolius* is recommended, although it is often cultivated as a pot plant. If the *Cyperus* has been used as a pot plant it must first be inured to the water by placing it in a pail of water with the water flush with the top of the pot. Later the water is gradually raised. After several weeks of this treatment the *Cyperus* will be inured to the water and may be transplanted into the aquarium. The soil is then packed down firmly and evenly. Over this a layer of sand which has been washed perfectly clean is placed to prevent the water from becoming muddy.



A peculiar and very beautiful variety of gold fish

Plants, however, are placed in only one half of the aquarium. Draw an imaginary diagonal from corner to corner. That half of the aquarium containing the *Cyperus* is used for planting, while the other half holding the refuse corner remains free for the fish.

It is comparatively easy to plant water weeds. Bore a hole in the sand with the finger and place the roots of *Vallisneria* and *Sagittaria natans* in it. Then cover the hole with sand. The *Cabomba*, and similar small plants are treated differently. Only the tips of these plants are used for cultivation. They are almost buried in the sand, the tips only peep forth, for only that part of the plant which has grown in the aquarium remains green. These shoots, a few of which are usually placed in one hole, root very rapidly.

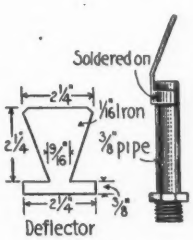
When the aquarium is completely planted it must be filled with water. To prevent the water from stirring up the sand, lay a piece of paper over the refuse corner. Pour the water carefully on the paper until the aquarium is about a quarter full. The rest should be siphoned in with a small rubber hose.

The aquarium should be placed in a well lighted window so that the plants may receive a sufficient quantity of light. When the plants have grown sufficiently, fish may be procured and placed in the aquarium. A convenient method of computing the number of fish an aquarium will hold is to allow a quart of water for every fish 2 in. in length.

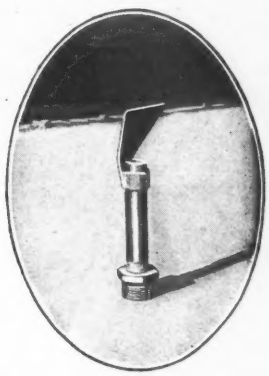
Such a balanced aquarium shows the family life of the fish. The Paradise fish builds a foamy nest on the surface of the water, plays at love making, lays its spawn and cares for its young. The peculiar and odd varieties of gold fish lay their spawn on delicate aquatic vegetation. The *Chanchito* digs a small ditch in which the young are taken care of. The stickleback builds a delicate nest for its spawn from plant fibers. This nest is a work of art rivaling many bird-nests. Mention may be also made of the mouth breeders, the female of which carries the spawn in her mouth until it matures.—Dr. E. Bade.

Making A Sprinkler Hoze Nozzle for the Boiler Room

THE illustration shows the details of an easily constructed sprinkler hose nozzle. The deflector plate is cut from 1/16-in. sheet or galvanized iron, and soldered to the pipe used as a tube. The angle of the



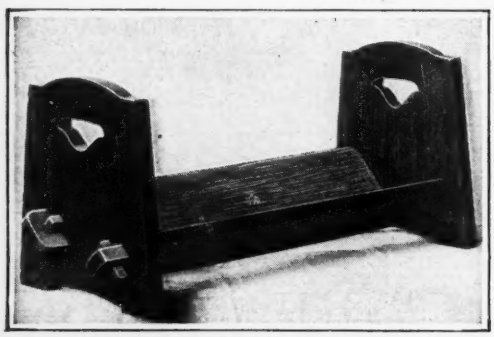
A deflector for a hose nozzle to make a sprinkler



spray is adjusted and governed by bending the neck of the plate. The whole arrangement is quickly and easily made and it is conveniently handled. It will be found very useful for many purposes, especially around the boiler room. —F. W. Bentley.

Making a Book Trough with Natural Wood Finish

BOOK troughs are pleasing variations of the conventional book rack and they serve a very useful purpose. Food for thought in the shape of books can be dished out in no better way than a book

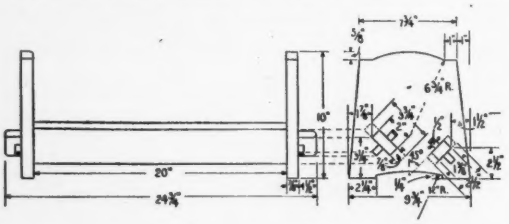


A simple conventional design for a book trough to be used on the library table

trough full of books conveniently located on the library table. The list of materials required for this one is as follows:

2 end pieces 10¼ in. square and ⅞ in. thick.
1 rail 25 in. long, 4 in. wide and ⅞ in. thick.
1 rail 25 in. long, 2¾ in. wide and ⅞ in. thick.
1 piece for keys 2¾ in. long, 1 in. wide and ½ in. thick.

The selection of the wood should be well considered. All dimensions given are generous, to allow for planing and finishing to the sizes given in the illustration. The layout for the ends is detailed, the mortises being marked from both sides to enable the worker to cut clean lines on both surfaces when chiseling out the stock. Cut the outline of the ends carefully on the band-



Dimensions of the parts of the book trough. These may be varied to suit the maker

saw or with a turning saw or scroll-saw if there is no band-saw at hand. Smooth the straight edges with a plane and the curves with a wood file. In cutting the mortises, bore holes first and then cut carefully to the size with a wood chisel, working from both sides.

The long pieces or rails joining the ends should be cut to width and length, and the tenons laid out and cut on the ends. The holes for the keys are next cut. Fit the tenons carefully to their respective mortises and mark them so that they can be returned to their places. Fit the keys carefully and mark them. The steel figures are just the thing for making these marks.

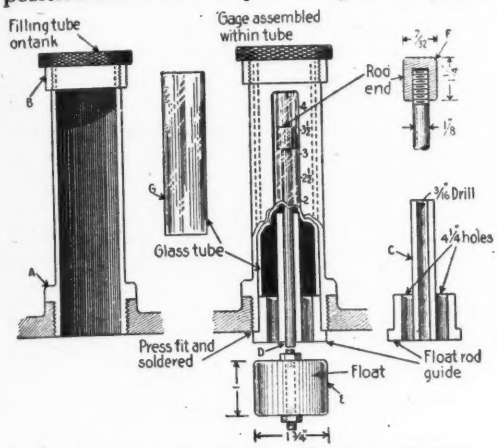
The pieces are now scraped and sanded and they are ready for the finishing process. A good oil stain gives the best results in the hands of the amateur. When oak is used, spread on the stain evenly and rub off the surplus. When this has dried for 24 hours apply a coat of filler which has been colored with a little of the stain used. Let it stand for a few minutes, or until it is dull, and then rub off the surplus with a piece of burlap, rubbing across the grain. After the filler coat has dried, apply two coats of shellac, spreading evenly. Rub the pieces with steel wool after each coat to prepare a smooth surface for the wax. Two applications of wax will complete the finishing process. The pieces should now be assembled, after which the book trough is ready for immediate service.—HARRY W. ANDERSON

A Homemade Oil-Gage for a Large Storage Tank

WHERE a large storage tank is kept filled with gasoline for private use it is necessary to have some means of knowing the quantity of oil within to prevent running short. The illustration shows a homemade gage constructed of discarded parts which can usually be found about a home garage or shop. The body of the gage consists of a breather-tube *A* and a cap *B*. A slot ⅜ in. wide was cut in the side of the tube, extending to within ¾ in. of each end. The lower end of the tube was rethreaded to fit in the threads of the filling hole. A guide *C* was turned to the shape shown from a piece of solid brass bar. The hole through the center was drilled to make a sliding fit for the rod *D*. Four ¼-in. holes were drilled through the base so that oil could be poured in when the cap *B* was removed. To hold the guide in place it is made a press fit, but it was finally soldered.

The rod *D* is a ⅛-in. drill rod with a float *E* fastened to the lower end. A knob *F* was fastened to the upper end of the rod, which served as a gage block and to prevent the

rod from coming out of its bearings. To prevent the oil gushing out through the slot cut in the brass tube a glass tube was inserted within, its diameter permitting a close fit in the hole of the brass tube. The length of the glass tube brought it into position so that the cap *B* clamped it in place.



A float gage made of odds and ends for finding the oil level in a large storage tank

The markings on the outside of the tube *A* for indicating the quantity of oil in the tank were determined by turning a ½ gallon of oil in at a time and making a mark. The marks were cut in with a machinist's scriber.—ADOLPH KLEIN.

An Emergency Repair on a Leaking Water Pipe

THINGS often break down at the most inopportune times. A number of years ago, the writer was called upon one Sunday morning to stop a leak in a cold water pipe which threatened to ruin the ceiling below. No plumber was to be had. The leak could have been stopped by shutting off the water altogether; but for several reasons this was impracticable for any length of time. I had a supply of friction tape such as is used by electricians for wrapping spliced wire joints. Shutting the water off in the cellar for a few minutes, I wrapped the tape closely over the hole, putting on several layers. Over this tape I wrapped several thicknesses of twine of which a plentiful supply was on hand. When the water was turned on, the leak was found to be completely stopped. The tape was left on the pipe seven days and answered well until a permanent repair was made.—W. S. STANDIFORD.

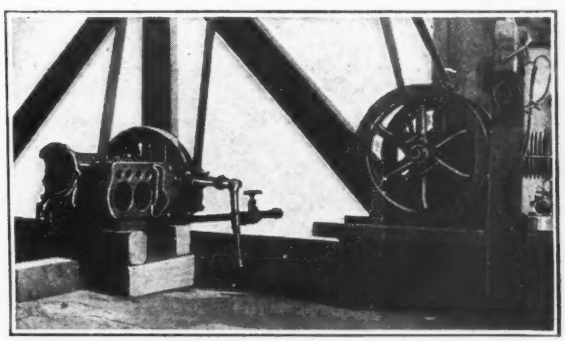
An Individual Strap-Hanger for a Crowded Car

THE tired shop-girl who is compelled to board a crowded car every day will appreciate this little hanger which she can carry in her pocket or bag. It consists of two large bone rings, such as are used by harness-makers, connected by a half-yard strip of strong webbing or tape, which can be quickly slipped through the usual hanger without inconveniencing another passenger who may be using it. Both rings are to be held together in the hand. The short woman who has difficulty in reaching the usual hangers will also find this convenient.—J. E. MCCOY.

A Garage Air-Compressor Made from an Old Automobile Engine

AS an air-compressor was badly needed in our garage, in spite of the fact that the quantity of business did not warrant the purchase of a high-priced machine, we built one from an old discarded engine from a small car. The engine had its water-jacketed head broken in half. On account of this only two cylinders were used for the compressor. The old countershaft and two pistons were assembled and bolted down to timbers. A heavy flywheel was keyed to the end of the shaft and this was belted to the line shaft of the garage.

This outfit easily kept up from 100 lb. to 135 lb. pressure. To hold this pressure a tank was constructed from a 10-ft. length of 8-in. gas main, which, being capped at each end, had an inlet and an outlet hole drilled in the caps. With this equipment the garage has ample air pressure for all purposes in the shop besides free air outside for tire pumping.—L. A. BENNETT



An old engine mounted on a wood base and driven by another engine for use as an air-compressor

A Door Catch Made from a Spring Shoe Tree

WITH this simple homemade catch you can push the door as wide open as you like and it will remain so. There are no levers to push down. It is self-contained and very cheap.

Manner of fastening the spring shoe tree to door for a stop

First secure a pair of "shoe trees." Take one portion, as shown in the illustration, and fasten the metal end on your door about 6 in. from the floor. Fasten it with nails, screweyes or anything that will hold. It is advisable to hold the metal end over the gas range for a few moments to take out the temper; then a nail driven through it will not split the metal. The tension of the metal after it is fastened on will push the wooden knob firmly on the floor. With the pressure "just right" you can move the door freely, yet it will remain wherever it is set. The knob will slide over a rug or doorstep. It will not be in the way if fastened on the inside of the door, and the wind will not be able to blow the door shut or further open.—CLARENCE T. HUBBARD.

Tearing a Pack of Cards in Half with Ease

ALTHOUGH the popular trick of tearing and quartering a deck of cards can be classed as a feat of strength, there is a "wrinkle" which, if mastered, will permit the pasteboards to be torn with very little exertion. The method described is a sure one, and is just as effective as if actual strength were used. A girl can do the trick if the instructions are carried out. Take a pack of new cheap cards and "bake" them in an oven for more than an hour. Cut a slit about ½ in. deep on each side of a card case. This cannot be seen, and when the cards are passed around for the usual preliminary examination by the spectators the case is retained by the performer, by whom the cards are returned to the case after the inspection. The cards after being baked will be very brittle and when placed in the case will tear easily, as the slit will give away and the two portions of the card case will act like grips in severing the 52 cards it holds.

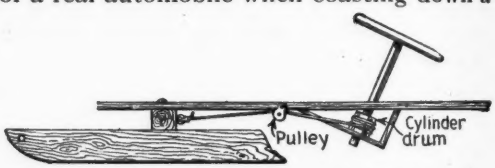
The cards will tear in two easily after they have been baked

Reshaping Artists' Paint Tubes for Refilling

THE tin-foil tubes used as containers for artists' colors are usually thrown away when empty. These can be refilled or used for other purposes by blowing them out with a bicycle pump. Sufficient pressure will straighten out all the kinks and render them almost as good as new. When blown out to their original size, open the bottom end, insert the contents and fold over again as before.—L. B. ROBBINS.

An Automobile Steering Wheel for a Bob-Sled

NO automobile ever has its steering wheel directly over the front axle, and no bob-sled to steer best should have the wheel over the front bob. The illustration shows an arrangement which has the "feel" of a real automobile when coasting down a hill. The steering wheel and post were set nearly half way back on the top plank of the bobs in a leaning position, like the wheel and post of an automobile. On the lower end of the post a wooden roller about 6 in. in diameter was fastened. About the middle of this a ¼-in. rope was wrapped several times, and then the ends were taken through a pulley on either side to the ends of the cross-piece of the front bob. Any turn of the wheel thus revolves the roller which wraps the rope, pulling the front bob in the direction desired. Such a pair of bobs can be built at home with materials found in the scrap heap. For my bobs I used seasoned oak, soft pine for the top plank, and old carriage tires for the runners. The wheel of an old corn cutter makes a fine steering wheel, or the steering wheel may be sawed out of hard wood with a compass saw.—F. E. BRIMMER.



Cylinder drum attachment for a bob-sled. It is like the steering mechanism of an automobile

Making a Trusty Bob-Sled

Plans for the construction of a coasting bob-sled that will carry several persons

By B. Francis Dashiell

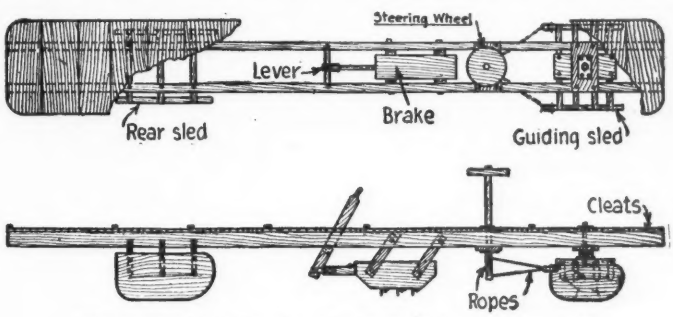
THE bob-sled described and detailed in the accompanying plans is very strong and capable of carrying any weight that can be placed upon it. The powerful brake and steering apparatus will give a strong sense of security when coasting down even the steepest inclines.

The frame should be built first. This consists of two lengths of spruce, pine or oak, 2 by 3 in. and 13½ ft. in length. The various holes and notches are cut and bored in the required positions as shown. At the location of the steering wheel and front or guiding sled, oak boards 6 in. by 12 in. and 1 in. thick are bolted across, as shown.

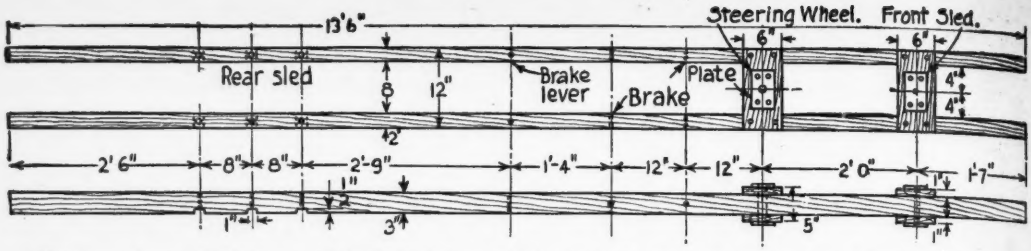
The sleds are next constructed. The rear sled is 24 in. long and 18 in. wide, the sides being of oak boards 10 in. wide and not less than 1¼ in. in thickness. The edges are rounded off as shown. Three cross-pieces of oak are cut out 18 in. long and 8 in. wide and notched to receive the side pieces and also the two long frame pieces. The parts of the sled are joined together with long screws. The front or guiding sled is of the same width as the rear sled but is only 18 in. long and the sides are only 8 in. high. Four cross-pieces are used on this sled and are made of oak 18 in. long and 5 in. wide. They are screwed between the two sides in the same manner as those of the rear sled. The top of each cross-piece has a notch ½ in. deep and 6 in. wide cut in it to receive the 6 by 16-in. oak board as shown. Use screws for all fastenings.

The runners for the sleds are made from iron bars ⅛ in. by 1 in. and bent around the edges of the sled sides. Screws are placed on about 3-in. centers and have their heads countersunk in the runners. Smooth the iron well with a file, then polish with oil and emery cloth. Make two iron straps or U-rings and bolt to the rear of each side piece of the front sled as indicated in the drawings. These are used to fasten the ends of the steering cables.

The brake is made from oak or pine 1 in. in thickness and is in the form of a box with the ends turned up or rounded off. The two side pieces are 6 in. wide and 18 in. long with the ends cut off at an angle of 45 deg. as shown. The bottom and ends are covered with 1-in. boards, using screws for fastening them in place. Get three 1½-in. iron angles 6 in. long, and bolt them to the bottom of the brake box as shown. The box is suspended between and from the two long frame timbers by means of four swinging arms, each of oak 12 in. long, 2 in. wide and 1 in. thick. Make all the connections with bolts, using washers and lock nuts. Rivet over the ends of the bolts to prevent the nuts from working loose and coming off. The brake is operated with a lever of oak 28 in. long, 2¼ in. wide, and 1 in. thick. It is pivoted on a cross-support bearing made of a 12-in. length of ¾-in. wrought iron water pipe. Make two plates from sheet iron about 1/16 in. thick and bolt one on each side of the lever. A hole with a diameter of 1-3/32 in. should be cut in the plates and lever so that it will fit nicely on the pipe bearing. Drill the holes in the pipe support as called for in the plans and then place the lever over the pipe. The two ends should now be hammered down flat and drilled for the bolts. Place cotters in the holes, one on



Plan and side elevation of a bob-sled that is capable of carrying any weight that can be placed on it



The two pieces of the frame of the bob-sled to which the bobs are attached on the underside and the cross-boards on the top; the two crosspieces shown are for the steering wheel post and the front bob

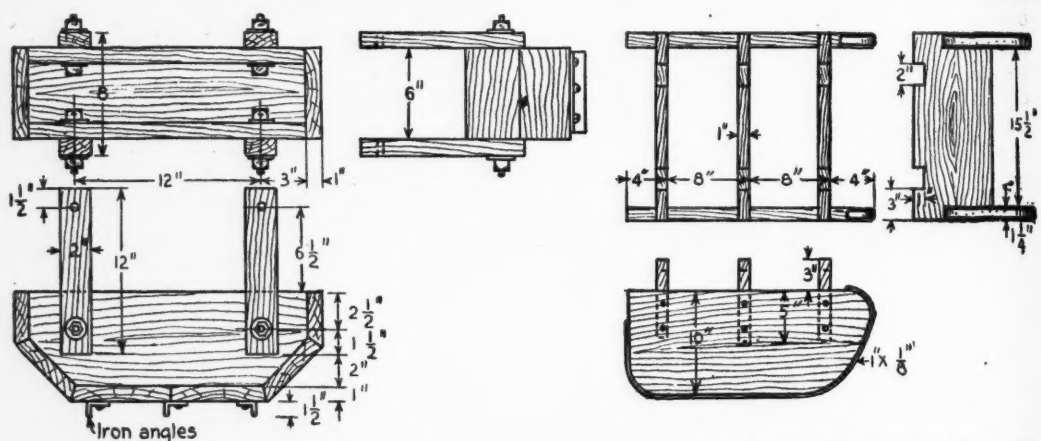
each side of the lever. This construction is clearly shown in the section taken at the brake lever.

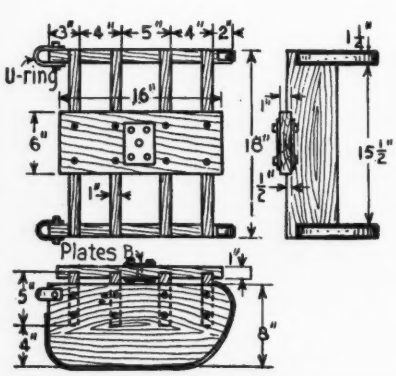
The rod that connects the brake lever to the brake is made of oak 10½ in. long, 2 in. wide and 1 in. thick. It is fastened to the brake box with a large heavy strap hinge and several bolts, as is shown in the brake connection detail. Connection with the lower part of the lever is made through two plates, one at each side of the connecting rod. The plates are bolted to the rod with two bolts. A heavy bolt passes through the ends of these plates and the lower hole of the lever, as is indicated. Use washers and locknuts, and rivet over the end of the bolt. The plates on the lever and the rod are to take up the wear and strain, thus preventing the wood from wearing and enlarging the holes.

The rear sled is attached by placing the notches of the two frame timbers over the notches in the cross-pieces of the sled. Drill holes through the frame timbers and fasten with heavy screws into the sled timbers, countersinking the screw heads about half way down in the frame timbers.

The front or guiding sled is next set in position. Make four iron plates 4 by 6 in., as at *B* in the illustration. Bolt two of these plates to the top board of the sled, one plate on each side; and bolt the other two to the cross-boards of the frame. The centers of these plates should be drilled to take a heavy bolt which should be 10 in. long. Place several washers between the sled and frame plates and drop the bolt down through the holes. Place two washers over the ends of the bolt and place on the nut and lock nut and rivet over the end of the bolt. These plates prevent wear on the wood parts and serve to keep the sled true and easy turning.

Cut out two wood disks from oak boards ½ in. thick and 10 in. in diameter and bore a 1¾-in.

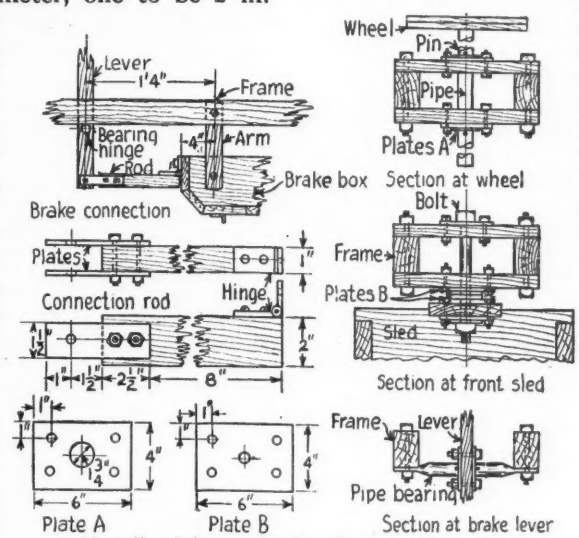




Details of the brake and the front and rear bob

hole in the center of each. Fasten these two pieces together with the grain running in cross directions or at right angles to each other. Get a piece of iron pipe 1¼ in. in diameter for the steering wheel shaft. It should be 27 in. long and drilled with two holes ½ in. in diameter, one to be 2 in. from the end and the other at right angles to it, and ¾ in. from the end. Fit a piece of rod or pipe with an outside diameter of ½ in. in the lower hole. The rod or pipe is to be about 9 in. in length. Now place the steering wheel over the pipe shaft and resting on the cross ½-in. pipe. Fasten the wheel to this cross pipe with four eyebolts as indicated in the detail drawing. Now slide in the other cross pipe which will just come on the opposite side of the wheel and fasten that with four eyebolts, also as indicated. This method gives a very solid and strong connection between the shaft and wheel. Smooth up the wheel with a file and sandpaper. The wooden wheel will be found easier and warmer to handle in cold weather than a metal one. Now drill the two cotter, and the ¼-in. holes in the shaft as called for in the illustration.

Make two plates and drill them to make a hole 1¾ in. in diameter for the 1¼-in. pipe to pass through. Bolt the plates to the upper and lower cross boards of the frame and then place the steering wheel shaft in place. Put on a sufficient number of washers to take up any play and insert two heavy cotter or taper pins—either will answer very well. This is clearly shown in the sectional drawing of the steering wheel and detailed at *A*.

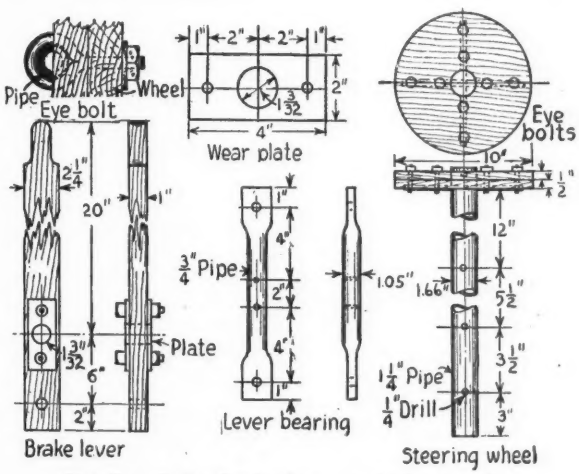


Details of the mechanism for operating the brake, the steering wheel and the front bob, all hung to the underside of the frame

The steering motion is carried from the shaft to the sled through a cable of either bronze or other metal — a flexible woven or stranded wire cable of ¼ in. diameter will answer the purpose very well. A length of the cable is passed through the hole in the lower part of the shaft and a knot tied in either side so as to prevent the cable from slipping through the hole. Make five turns of the cable around the shaft below the hole, from left to right and take five turns from right to left above the hole. Fasten the two ends to the rings on the rear of the sled, being sure to draw the wire tight before fastening.

The sled should be covered or floored from end to end with some light weight material, the planks being nailed crosswise. Each plank length, or the width of the flooring on the sled, should be about 20 in. Nail on cross footrests or cleats as desired.

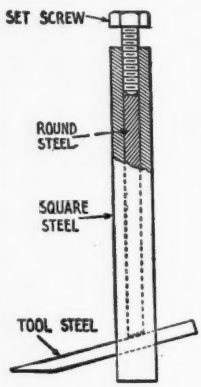
The brake box is supposed to be filled with some heavy stuff so that its own weight will suffice when only a slight drag or braking is wanted. Fix up a hook and chain so that the brake handle can be held down when not in use. A strong pull on the handle will stop the sled.



Details of the brake lever and the steering wheel and post with cross-bar for the ropes

A Steel Boring Mill Tool-Holder Requiring Little Material

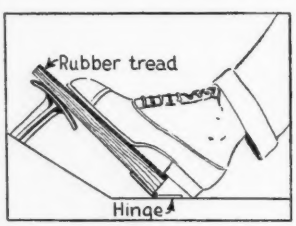
WITH the price of high speed tool steel soaring, devices for the conservation of this kind of material are being sought. With this thought foremost the device for holding a boring mill tool, as illustrated, was developed and a great saving in material effected. The entire tool, made of high speed steel, will weigh about 1½ lb. The piece of steel used in the holder weighs about 4 oz. This holder can be made in a variety of shapes, and different tools can be used. Pressure exerted by the set-screw on the round-pin holds the tool in place. The round pin is roughened or knurled on the end to hold on the steel surface.—J. R. MINTER.



A steel tool-holder for a boring mill

A Treadle for an Automobile Foot Accelerator

ON a great many cars the accelerator consists of a plunger rod, with a metal disk at the end, for the foot to rest upon. As it is often difficult to keep the foot pressure steady upon the button, a constant increase and decrease of speed is the result.



Treadle to ease the foot on accelerator pedal

With this in mind, I constructed a treadle along the lines shown in the sketch, which overcomes, to a great extent, the uneven pressure, and also gives an easier position for the foot.

The under side of the treadle was channeled so as to keep it always in place on the button. The top surface was furnished with corrugated rubber and the lower end hinged to the car floor. As a result the car ran much more smoothly and the leg muscles were relieved from the constant strain of adjusting the pressure upon the accelerator.—L. B. ROBBINS.

An Improvement on the Old-Time Back to Back Card Trick

THIS trick originally consisted in reading off the cards one by one as they were shown to the audience without your having had a chance, apparently, of seeing them at all. The secret consists in placing two halves of the pack back to back, so that one half faces one way and the other in an opposite position. Notice what the face card is on one side and hold the pack up so that the audience can see it. While you are doing this you will have a chance to notice the rear card, that is the card facing toward yourself. As soon as you have done this place the pack behind your back or under the table and transfer the rear card to the front of the pack, thus bringing into view the one you have just named and at the same time disclosing the next card in the rear. On holding the pack up to the audience you will be enabled to name the card next to appear. It is needless to say that no one should be allowed behind the performer while this trick is in progress.

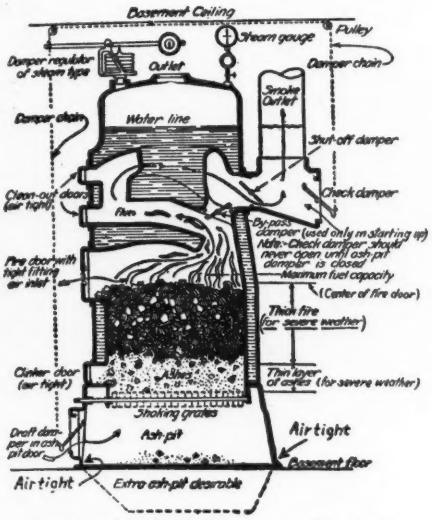
The variation of this trick employs a mirror in order to deceive the "knowing ones" who are familiar with the older method of working it. For this newer method, the pack is not cut and put back to back, but the cards all face in one direction. Somewhere overhead a mirror is placed where it will reflect the cards to you, but in such a position that it will not be seen by the spectators. As the cards are reflected in this you will be able to read them off without lowering the cards. Be careful to hold the pack between your eyes and the spectators so that the direction of your glance is not detected.

Newspaper as a Substitute for Chalk Talk Lecturers

CHALK talkers, lecturers and teachers who use paper and crayons to show diagrams, sketches, figures, etc., now find the prices of large sheets a serious consideration. Their outlay may be materially reduced if they will use old newspapers that have a comparatively even gray appearance from a distance. Select the sheets that have no dark or heavy cuts, headings and the like, such as the "Help Wanted" pages, and use the regular "chalk talker's" crayons. The printing will not detract from the drawing; in fact it can scarcely be noticed by the audience.—A. B. WAGENER.

Coal Is Dear. Learn How to Burn It in the Furnace

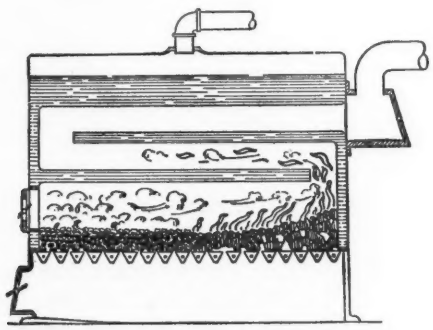
THE many little leaks in the boilers and furnaces of our homes are going to cause a waste of a hundred million tons of



Sectional view of a small steam heater showing necessary dampers and doors for proper regulation

coal in a year unless we do something about it. The remedies for these leaks are simple and it behooves all of us to give attention to them this winter.

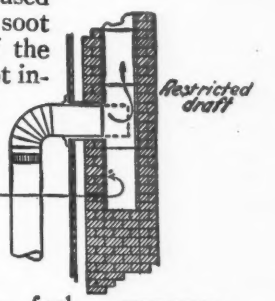
The problem has been studied by the Engineering Experiment Stations of the



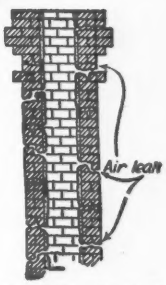
The first stages of the coking method of firing in which fresh coal is spread over only the front of the fire pot

University of Illinois, and some results of that study are summarized here.

The most important single part of any heater is the grate. It should be large enough to allow sufficient air to feed through the coals to form a highly combustible mixture. The setting of the furnace should be airtight to prevent too great a draft when the fire is burning low. This applies equally to the doors of the furnace, and even the slides. Then, too, the cleaning doors should be used often to remove the soot from the interior of the heater, since the soot insulates the water from the heat of the fuel. If just these three points are heeded, you can save as much as twenty per cent. of your fuel expenses.



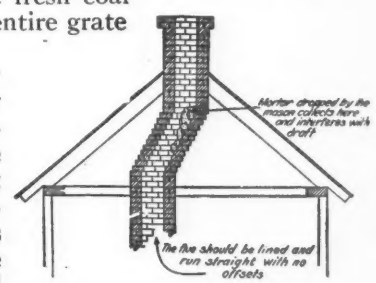
Next in importance is the consideration of the draft. This must be capable of being accurately increased and decreased at all times. This means that first of all your chimney must be airtight and minus obstructions of any kind. The top of the chimney should be at least two feet above the surrounding objects so that the wind can create a strong enough draft.



Draft is checked by a defective or broken joint in the chimney

Another point so often neglected by house owners is the matter of firing. Fresh coal should be shoveled only at the very front of the fire bed at first. This assures the burning of the gases that escape when the coal becomes heated. The gases must pass over the coals on their way to the chimney. After a few minutes, you can spread the fresh coal over the entire grate area.

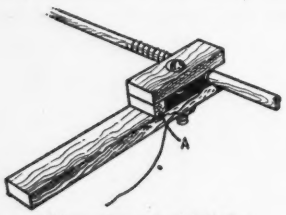
Only two other points remain. The first is that all distributing pipes should be covered with asbestos sheeting to prevent radiation. The second concerns weather strips which should be attached to all doors and windows.


Mortar dropped by the mason collects here and interferes with draft
The flue should be lined and run straight with no offsets

Showing what may happen in an offset chimney

Winding a Coil Spring Automatically and Evenly

A SPRING-WINDER that will wind accurate and evenly spaced coils can easily be made out of two pieces of hardwood and an ordinary stove-bolt.



The wire is held tight until the winder can be placed as shown and clamped tight

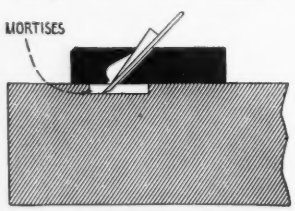
Take 2 pieces of ½ by 1 in. close-grained hardwood, one about 8 in. long, the other 3 in. long. In the center of the 3-in. piece drill a hole of a size to easily take a stove-bolt. About 1½ in. from one end of the long piece drill a similar hole. A small block of wood *A*, of the same diameter as the mandrel on which the spring is to be wound, completes it.

To wind the spring, fasten the mandrel and the end of the wire in the chuck. Start the lathe slowly, winding the spring by hand until the proper space between coils is obtained. Hold the wire tight until the winder can be placed as shown in the sketch and clamped down tight enough to force the wire into the wood. If it is too tight for the lathe to turn, loosen slightly.

By letting the end of the winder rest against the lathe bed, it will feed itself along automatically, thus leaving both hands free for handling the coil of wire.—F. L. MATTER.

Making Butt Mortises with an Ordinary Rabbet Plane

LEVELING the bottom of a butt mortise is usually the most difficult part of the job, but this work can be done quickly by using a small plane, preferably a narrow wood rabbet plane. All that is necessary is to set the cutter down below the bottom of the plane a distance equal to the depth of the mortise and cut out the stock to be removed after making a few chisel cuts in the customary manner. The plane will cut out the chips and accurately level and gage the bottom.



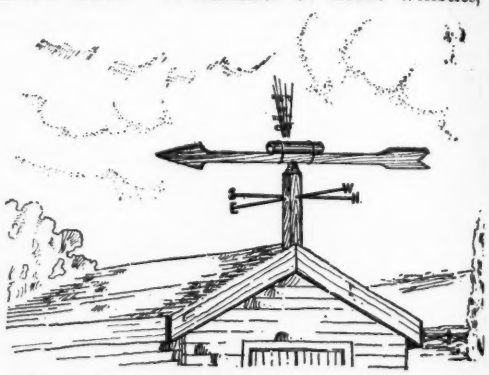
Cutter set deep in plane to cut mortise

Making a Talking Machine Stylus Out of a Toothpick

OWNERS of talking machines will find a toothpick an excellent substitute for a record needle should the supply of steel needles give out. The toothpick should be whittled to a fine point at one end and cut off blunt at the opposite end. Insert this improvised needle in the reproducer, point end down. The result will be a soft, pleasing tone. It can be tried as a novelty or to help out in case of an emergency.—CLARENCE T. HUBBARD.

Making a Whistling Weather Vane for the Barn

AN ordinary wood or metal whistle is used for this novel device. It is attached to the crossbar of an ordinary arrow weather vane with the open end toward the arrow head. A number of these whistles,



The whistle placed on the weather vane is always in the right direction to sound its note

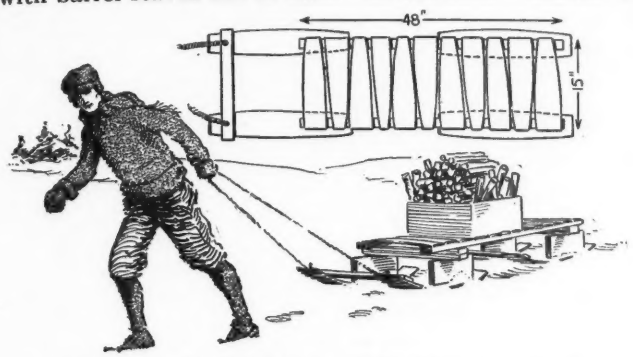
each of a different tone from the others, all on the same scale and each attached to an individual weather vane will make a pleasing and peculiar concert on a windy day.—VAUGHN BAKER.

Hand Bob-Sleds Made of Barrel Staves

THE illustration on the following page shows a pair of hand bob-sleds that did fine service about a farm, when it became necessary for one man to carry bags of feed, grain, wood, etc. They can be made in half an hour's time and from no other material than some barrel staves and pieces of 2 by 4-in. sticks.

Select four good staves for the runners. On each one nail a block of the 2 by 4-in. stock of any convenient length by its thin edge. Spike a cross-piece 15 in. long from

the bed piece of one runner to the other. In the front bob use an inch board for this piece, as it must turn. Two pieces of the 2 by 4-in. material about 48 in. long should be nailed in place for the top, covering these with barrel staves cut in half. In the case



The runners on this bob-sled are made of barrel staves set on knees supporting the top which is also made of staves

of the front bob a 1-in. piece should be used to hold the two top pieces in place. A hole is bored through for the king bolt. It is a good plan to strengthen the front end of the runners by a 1-in. strip. Attach the rope by which you will pull the sled, and you have a handy set of bobs that cost practically nothing.—F. E. BRIMMER.

Fruit-Jar Rubber Ring to Repair Bicycle Tire Puncture

A SATISFACTORY repair for a small puncture in a bicycle inner tube or bicycle single tube can be made by taking a common fruit-jar rubber ring, previously melted by holding over the flame of a match, and applying it over the puncture if in an inner tube, or by forcing it into the puncture if in a single tube.—H. K. CAPPS.

Cutting Rafters for Gothic Roof Barn Construction

THE farmer who is anxious to have a barn that is different, distinguished looking, and out of the ordinary and at

Manner of cutting the material for making a Gothic-roofed barn to provide mow space that is free from trusses or cross-beams

the same time practical and strong will be impressed with the Gothic-roofed barns. The rafters start from the plate and curve to the peak where they meet at a sharp point. The main rafters are placed every 6 or 8 ft. apart, depending on the size of the barn and are tied together by 2 by 4-in. pieces that run crosswise or lengthwise of the structure. These 2 by 4-in. pieces are "dapped," that is, set into the main rafters, almost 1 in. Then to these 2 by 4-in. pieces are nailed 1 by 4-in. pieces in the opposite direction or running from plate to peak, so as to support the roof sheathing boards. Since the 2 by 4-in. pieces have been set into the rafters 1 in., these 1 by 4-in. strips will be just flush with the rafters. The rafters are built up out of 1-in. boards cut out with a band saw in segments to fit the curve. Mark out the roof pattern on the barn floor and build all rafters before hoisting them into place on the plates. Gothic roofed barns are exceptionally strong on account of their shape; the mow is free from trusses or cross-beams, but will stand heavy winds in spite of the light framework. These barns are very neat and exceptionally attractive.—W. E. FRUDDEN.

The Proper Care and Upkeep of a Soldier's Wardrobe

THE 84th Article of War states that "Any soldier who sells or wrongfully disposes of or wilfully or through neglect injures or loses any horse, arms, ammunition, accoutrements, equipment, clothing, or other property issued for use in the military service, shall be punished as a court martial may direct." The prescribed punishment for violation of the above article is three months confinement at hard labor and forfeiture of two-thirds pay for three months if the value of the articles lost or damaged is less than $20.00; if more than $20.00 and less than $50.00 the penalty is double that given, and if the value is more than $50.00 the penalty is six months confinement at hard labor and a dishonorable discharge forfeiting all pay and allowances due and to become due. If any of the articles are sold or otherwise wrongfully disposed of the penalty is a dishonorable discharge and from six months to five years confinement at hard labor, depending upon the value of the articles sold or disposed of. Attention is called to the first penalties outlined, as they apply to "injuring or losing, through neglect." Certainly it behooves the

soldier to take care of the clothing and other articles issued to him in order to escape severe punishment. Again, it is not the slovenly soldier who gets along well with his officers and wins promotion, but rather the one who takes good care of his clothing and equipment and keeps himself looking clean and fit. The following suggestions may be of use to the recruit who really wants to "soldier" correctly.

1. Always keep a complete uniform for inspections, parades and ceremonies, thereby avoiding extra details for being unpresentable at these formations.

2. Fold all clothing carefully and with the fewest possible creases, and be sure that it is thoroughly dry before putting it away. See that all buttons are in place, that all spots are removed and all torn places mended so that when it becomes necessary to put the clean things on in a hurry they will be ready to wear.

3. Wash the leggins often with laundry soap and a stiff scrubbing brush. They will dry in half an hour in the sun and may be washed between formations if necessary.

4. As a rule, never dry anything in the sun as the color will fade; but leggins are seldom harmed by the sun.

5. Sweat stains cannot be removed, so do not worry yourself sick over them. The color may be partially restored by dipping the garment in a solution of one part of ammonia to two parts water.

6. Remember that gasoline or benzine will remove grease spots and also that both are highly inflammable. Paint spots can be removed with turpentine.

7. Watch your shoes and keep them repaired. Keep a whole sole under you and keep the heels straight. Shoes require an oily dressing and saddle soap should be well worked into the leather at least once a week. This removes the old polish and allows a higher polish with less effort. It also helps preserve the leather and assists in making the shoes waterproof.

8. Never dry wet shoes, or any other leather for that matter, with artificial heat or in the intense heat of the sun. Heat a collection of pebbles and put them in the shoes if it is necessary to dry them in a hurry.

9. Use only the best polish. Never clean tan shoes with lemon juice or acid as it has a tendency to rot the leather.

10. New shoes can be fitted to the foot, or "broken in," by putting them on and standing in water until they are well wet and then walking two or three miles in them. Take them off and immediately rub saddle soap or oil into them and they will be none the worse for the experience but will fit like an old shoe.

11. Leather goods in general should be washed off with a thick lather of castile soap and clean water. Rub them well so as to remove all salt, sweat and dirt. Oil occasionally or rub in saddle soap. A little neatsfoot oil is beneficial at times but too much of it has a tendency to rot the stitches. Neatsfoot oil should never be used on any leather which will come in contact with a horse's hair as it will burn the hair off. Oil should be applied while the leather is damp and should preferably be applied from the under side.

12. Have plenty of socks and underwear and change them every day. If it is impossible to carry a large supply of these articles they should be washed every night. Sweaty underwear causes chafing and that means misery to the infantryman. Dirty socks or socks with holes or rough darns in them cause blisters on the feet and make marching a thing to be dreaded.

13. Keep all of your buttons buttoned at all times. An unbuttoned pocket, shirt sleeve or neckband has been the cause of a good many days kitchen police being given out as punishment.

14. Watch your shoe, leggin and breeches lacings and put in new ones before the old ones break at some inopportune time.

15. Keep your hat brim flat, just as it is issued to you and don't turn it up or down. Wear your hat on top of your head and not on the back of it.

16. Be as careful about keeping your clothing clean as you are about keeping your body clean.

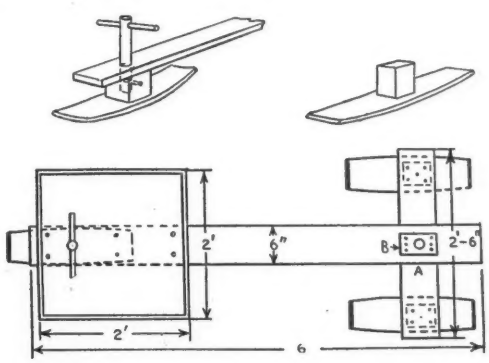
Improving the Writing Qualities of Cheap Lead Pencils

THE ordinary cheap lead pencils can be greatly improved, the sharpening made easier and the lead made to wear better, by soaking them in linseed oil. Use boiled oil and add a few drops of perfume. Immerse the pencils for three-quarters of their length, placing them in a vertical position in a bottle or tin can. Keep them in the solution for seven days. Remove them, wipe off the surplus oil, wash in benzine and let them dry. You will find the writing qualities greatly improved by this process.—W. S. STANDIFORD.

A Barrel Stave Iceboat

AN iceboat that will scoot across the ice at tremendous speed with little risk of an accident must appeal to every boy and girl, but the cost of such a plaything is generally too great and the difficulties of making a small one are often beyond the young mechanic; however, there is no reason why every boy who can handle a saw and hammer should not be able to build a boat with barrel staves for runners as described here, since the construction is simple and the materials inexpensive.

Procure an old barrel with stout, thick staves, and knock it apart, selecting three of the best staves for the iceboat. Barrels in which oil, molasses, tar, and hardware have been packed are the best, as the staves are thick and stout and will not split easily. There will be needed three perfect staves of equal length and thickness for the boat. The underside of these should be well polished with sandpaper until they are smooth. Three blocks of wood are then cut out 6 in. long and 3 in. square. Nail one of these blocks to each of the three staves, driving long wire nails in from the underside. In the center of one block bore a 1-in. hole 4 in. deep. This is to receive the steering post. Procure a board 2½ ft. long, 4 in. wide and 1 in. thick and nail it on top of two of the blocks, thus joining the two forward runners of the iceboat together. It is now ready for the main carrying board. This should be 6 ft. long, 6 in. wide and 1 in. thick. An oak or pine board that will not break when loaded should be used. Nail it to the cross board as shown at *A*, about 6 in. from the end, and fasten the other end to the steering runner by means of the steering post. Bore a 1-in. hole through the board at the proper place and put the steering post through it, driving it firmly into the hole in the block of wood. The hole in the runner board must be long enough so that the steering post will work in it freely. The steering post should be of stout oak 1 ft. long and 1 in. in diameter. It should be a tight fit in the hole in the runner block and nailed to prevent turning.



General details for making a smooth-running, speedy and very economical iceboat in which the runners are barrel staves

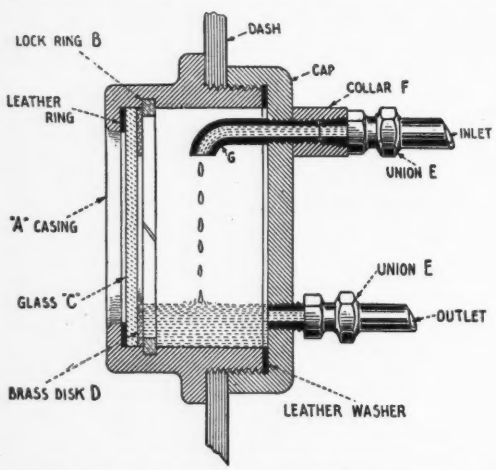
The body or hull of the iceboat is then finished, although the builder may desire a cockpit for comfort. This can be made of any box of the right size nailed to the runner board, with a hole bored through the bottom for the steering post. The mast can be cut in the wood or made from a fine bamboo fishing pole, which although light is strong enough. Nail a block of wood 2 in. thick with a hole in the center at the place *B*, for the mast staff and insert the butt end in it. To brace it in position run a stout fish line from screw eyes on either side and forward to a point half way up the mast. No back brace will be needed as the sail will pull in this direction, keeping the mast perfectly steady and in an upright position.

Obtain two light bamboo sticks for the boom and gaff and make the sail from any material at hand. Unbleached muslin is cheap and it makes a very good sail. If it is not wide enough the strips may be sewed together. A good length for the mast is three-quarters the length of the boat. The boom should be just long enough to clear a person seated in the cockpit. The sail should be laced to the mast and boom with stout twine or fish cord. This will make it loose enough to permit a good fit, and in a wind it will blow out smooth and snug. A sheet rope is provided so that the sail can be readily handled from the cockpit and "trimmed" as the sailors say, to suit any breeze that blows.

With a small iceboat of this character one can sail with the wind or sideways at great speed. When the craft is first launched rub some thick grease on the bottoms of the staves to make them slide along easily. In time they will wear so smooth that no grease or oil will be needed. The bottoms of the staves can be covered with thick tin if desired to increase the speed of the boat, but as a rule it will go fast enough for all ordinary purposes.

A Homemade Sight-Feed Oil Indicator for an Automobile

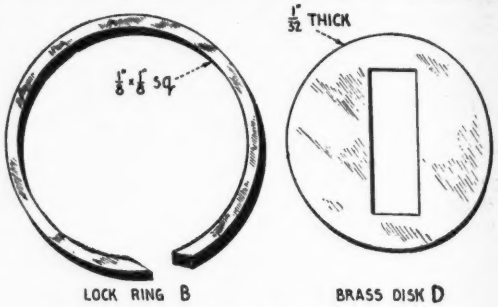
THE lower-priced cars are not usually equipped with an oil-gage or indicator, and consequently, if engine trouble occurs, the driver does not know whether it is the



A sight-feed oil indicator made from various odds and ends collected from the scrap pile

fault of the lubricating system or not. The addition of some form of sight feed placed somewhere on the dash will readily show any trouble of this nature which occurs.

We seldom realize when gazing at the junk pile in some forgotten corner of the garage-shop with what a little amount of effort many of the discarded parts collected



Lock ring and brass disk for holding the glass in the casing to prevent oil leakage

there could be made to save both time and money in making quick repairs or in rigging up some handy device.

The device illustrated herewith is the simplest form of a sight feed. It was made out of a discarded octagonal hub cap, *A*, the flat portion of which had been removed on a turning lathe. Directly beside the portion removed, a square groove was turned on the inside for the purpose of holding the ring *B*, which served to hold the glass *C* and brass disk *D* in position. The cover *E* was made from a cast iron pipe end, the thread on the inside of which fitted into threads on the outside of the body *A*. The brass pipe unions *E* were tapped into the cap *D*, the lower one being fastened directly, and the upper through the medium of the collar *F*. The tube *G*, bent at one end, and provided with a thread at the other, was inserted within the casing to so guide the stream of oil that its flow might readily be noticed. Leather gaskets were inserted as shown to prevent leakage. The method of connecting the device is clearly shown in the illustration.—ADOLPH KLEIN.

Removing Nitric Acid Stains from the Hands

IT IS next to impossible to remove nitric acid stains from clothing, if it has not already burnt a hole through the material. But the yellow stains can be removed from the hands by applying permanganate of potash at the end of a glass rod or dropper, and then washing them in water. This treatment turns the stain brown. The hands are then dipped in dilute hydrochloric acid (muriatic), and then washed

Simple Designs for Sheet Metal Working

VII.—Development of patterns for tee-joints of various angles

By Arthur F. Payne

Former Director of Vocational Education at Columbia University

TO those who have followed this series of articles, the new elements in the development of patterns to be considered now will be easily mastered. The tee-joint made of square pipe, as shown in Fig. 1, was chosen to illustrate this problem, because it is much easier than the tee-joint made from round pipe, although the method used is the same in both cases.

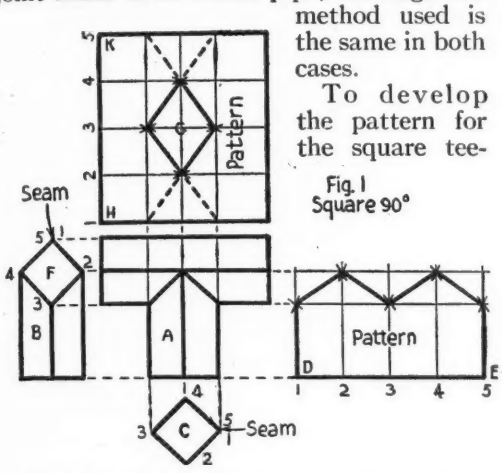


Fig. 1 Square 90°

The manner of laying out the lines in making a draft for a ninety-degree square pipe

To develop the pattern for the square tee-joint having an angle of 90 deg., first draw the front view *A*. Be very careful and do not confuse the diagonal size of the pipe with the square size. It is best to make sure of this by drawing the end view *B* the size wanted; then project the sizes to the front view, and draw the bottom view *C*. Number the corners from 1 to 5 as shown. To develop the pattern for the vertical pipe, draw the base line *D-E* and find the length of this base line by laying off the distances between the numbered corners on the bottom view *C*. Draw lines upwards from these points on the base line. Project corner 1 and 5 on the bottom view upward until the line strikes the bottom of the horizontal pipe; then run the line over to the right until it crosses the lines 1 and 5 coming up from the base line *D-E*. Make a cross where the same numbered lines cross each other, and run up and over corners 3, 2 and 4 from the bottom view and over to the right until they intersect the similarly numbered lines coming up from the bottom view. Connect the crosses with straight lines and you have developed the pattern for the vertical pipe.

To develop the pattern for the horizontal pipe, number the corners of the pipe, as shown in the end view *F;* project upwards the width of the pipe and lay off the correct length on the line *H-K* by stepping off the distance between the numbered corners of the end view. To develop the pattern for the hole *G*, project point 2 of the end view over to the front view until it strikes the joint line, then go upward until it crosses the line 2 coming up from the line *H-K*, and make a cross where the lines come together. Do the same with points 4 and 3. Connect the crosses with straight lines and you will have the pattern for the horizontal pipe.

The hole *G* in this pattern will have to be cut out with a chisel or a hollow punch. Some metal workers object to this and prefer to have one half of the hole on each edge where it can be easily cut out with a pair of snips. The dotted lines on the pattern show where the hole would be in this case. To develop the pattern with the hole on the edges, simply mark the seam at the bottom of the pipe at 3 and number it 1 instead of 3.

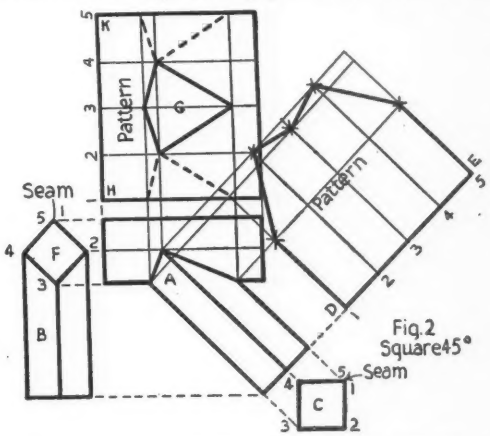
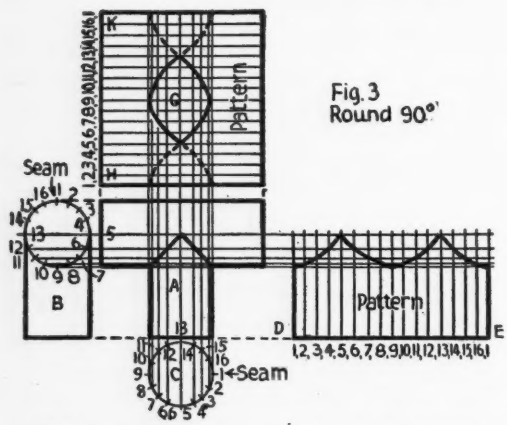


Fig. 2 Square 45°

A square pipe pattern of forty-five degrees is developed like one of ninety degrees

To develop the patterns for the square

pipe tee-joint, set at an angle of 45 deg., as shown in Fig. 2. The method is exactly the same as for Fig. 1. Draw the front view *A* (to get the correct angle follow the method given in the last part of this article on easy method of laying out angle). Draw and



This pattern for a round pipe is developed in the same manner as for the other types

number the bottom view *C*. Lay off the base line *D-E* and project lines over for the pattern. For the pattern of the horizontal pipe, project the length upward and get the length of the line *H-K* by stepping off the distances from the end view *F*. To get the hole *G*, run the points over from the end view *F* on the front view *A*, then upward until they cross the same numbered lines coming from the line *H-K*.

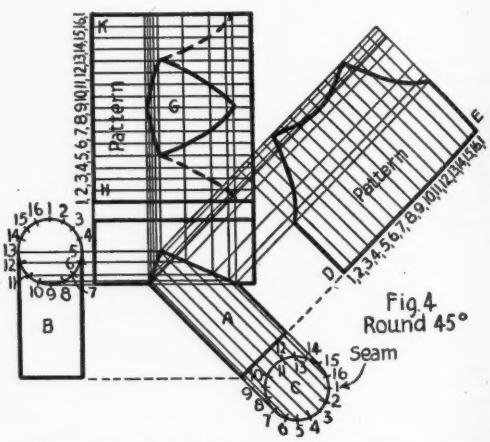
The method of developing the patterns for the round pipe angle of 90 deg., shown in Fig. 3, is exactly the same as in the square pipe Fig. 1. A larger number of lines must be used in this round pipe than in the square pipe and the method, though the same, may appear more complicated. Draw the front view *A* and bottom view *C*. Divide the bottom into 16 parts. Lay off the base line *D-E*, and step off 16 spaces equal to the spaces on the bottom view. This will give the correct length of the base line. Project lines upwards from the bottom view until they strike the joint lines, then project them over to the right until they cross the same numbered lines coming up from the base line *D-E*. Connect these crossing points with a curved line and you will have the pattern as shown in the drawing.

To develop the pattern for the horizontal pipe, draw the end view *B* and divide it into 16 parts. Lay off the line *H-K* the correct length by stepping off sixteen spaces from the end view; then draw lines across from these points. From the end view run points 13 and 5 (which are shown as one line on the drawing) over to the front view until they strike the lines 13 and 5 coming up from the bottom view *C*. Run them up to the pattern until they cross lines 13 and 5 on the pattern. Do the same with the other points. The dotted lines show the half hole on the edge as explained for the drawing Fig. 1. The pattern for round pipe tee-joint having an angle of 45 deg., shown in Fig. 4, is developed in the same way as for the other three joints.

Allowances for lock seams should be made on all these patterns as explained in a previous article.

Easy Method of Laying Out Angles for Tee-Joints

Angles are sometimes laid out by means of an instrument called a protractor, but an easy method is shown in the illustration. A circle, Fig. 5, contains 360 deg.; a half circle contains 180 deg., and a quarter-circle gives an angle of 90 deg. In the circle, Fig. 6, is shown a quarter-circle divided in half, which gives two angles of 45 deg. each; the other quarter-circle is divided into three equal parts, which gives three angles of 30 deg. each. If all of the degrees in the various angles are added together they will total 360 degrees.

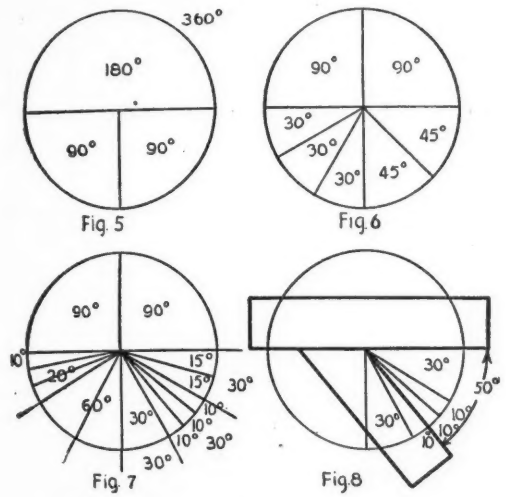


The plan of development of a pattern for a round pipe is the same as for the square

In the circle, Fig. 7, one quarter of it is divided into three equal parts of 30 deg. each, one of which is divided into two equal parts of 15 deg. each, and the other into three equal parts of 10 deg. each. The other quarter-circle is divided into three

equal parts of 30 deg. each. Two of them added together give an angle of 60 deg. The other one is divided into three equal parts of 10 deg. each, two of which added together give an angle of 20 deg.

The circle, Fig. 8, shows how tee-joint



Dividing a circle into degrees to obtain the right angle in drafting an elbow pattern

angles may be laid out quickly by this method. Just suppose that a tee-joint of 50 deg. is required. Draw the circle and divide it into four quarters, each of which will be 90 deg. Take one of these quarters and divide it into three equal parts. These will be 30 deg. each. Take the middle one of these and divide it into three equal parts of 10-deg. each. If a 30-deg. angle is added to two 10-deg. angles you will have a 50-deg. angle, which is the angle desired. Draw the front view of the tee-joint on the 50-deg. lines as shown in the drawing.

A Garden Hose Used as a Form for Cement Pipe

A FARMER wanting to construct a cement pipe to conduct water from a spring into the house and barn, dug a suitable ditch, poured in part of the concrete, and placed a hundred feet of garden hose in the center, filling up the ditch. Before the hose was placed in the ditch it was filled full of water with a force pump. When the cement set, the water was allowed to run from the hose. Then the hose was easily pulled out and used for the next hundred feet.—F. E. BRIMMER.

Repairing a Scratch on the Varnish of an Automobile

IF the scratch has gone no deeper than the finishing coat of color, take a fine thin striper or pencil, and draw a fine line the entire length of the scratch, endeavoring to fill the depression, but not running over the edges.

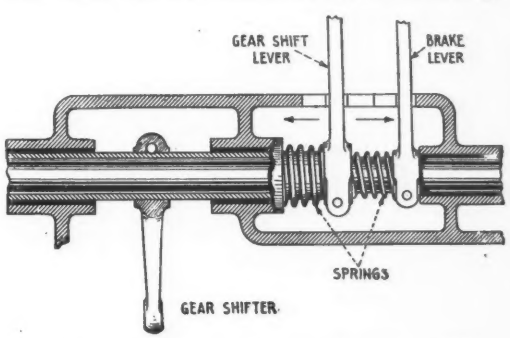
The varnish should be thinned with turpentine so that it will give a smooth surface and dry rapidly.

If you don't happen to fill the scratch, it will be all right as long as you get it glossed over. To be sure, the line may show on close examination, but from a short distance it will be invisible.—JAMES M. KANE.

Eliminating Noise from Shift Levers On an Automobile

A CAR that had developed a case of noisy shifting levers for both change speed gears and the brake was recently brought into our garage. An examination revealed the cause of the trouble to be the bushing of the lever hubs against the gear case when the gears were being shifted or the emergency brake applied. We inserted a comparatively light helical spring beside the hubs of both levers. These springs served a twofold purpose. They helped to minimize the shock when shifting, and prevented the lever hubs from touching the case, thus entirely eliminating the noise.

When employing a remedy of this kind, care should be taken to make the springs of wire that will not cause trouble in shifting,



Coil springs inserted between the shift levers to take up wear and prevent noise

and to see that the springs when compressed do not occupy too much space; otherwise the amount of travel allowed for the shifting may be decreased to such an extent as to prevent proper shifting.—ADOLPH KLEIN.

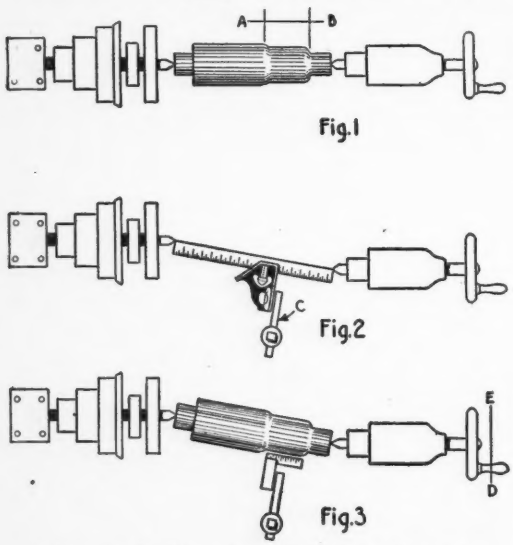
Protecting Drawings on Front Edge of Drawing Board

WHILE making large drawings it is often necessary to allow the drawing to extend over the front end of the drawing board. To prevent the worker from crushing the drawing paper while in this position, simply fasten a thin strip of wood to the front end or edge of the board with a small block under each end. Allow the extending edge to drop behind the strip and it will be well protected.—THOS. W. BENSON.

Setting a Lathe Quickly for Taper Turning

A SHOP recently received an order for turning a large number of tapered brass plugs of varied lengths and diameters. The lathe on which the orders were filled as they came was an old one, not having the common taper attachment, which would have made the job an easy one. The taper per foot in inches was of course given with each lot. The illustration shows the manner of setting the tapers, which, though they did not afford the rapidity of an up-to-date machine, gave excellent results.

One of the plugs out of each lot was



Manner of setting the tailstock of a lathe for turning a taper of a given length and size

turned back for about 4 or 5 in. of its length with the centers in line, as shown in Fig. 1, *A-B*. The tail-stock was then set over to one-half the given taper, and the end tips of a 12-in. box scale brought in contact with the center points. In Fig. 2 a piece of steel *C* squared on three sides was then drawn fairly tight in the tool post and tapped with a hammer to bring it in line with the face of the square head. The tool post was then run back and the work again placed in the machine. A small square was placed against the piece *C*, and the tail stock again thrown either way until the leg of the square was exactly in line with the turned portion *A-B*. This afforded the distance *D-E*, Fig 3. The sizes at the ends could then of course be readily turned. There are other ways to secure tapers by trial cuts which give good results, but owing to the size of the work in this case the method used was the most practical since it gave close and exceptionally accurate results.—F. W. BENTLEY.

Making a High Gloss Finish on a Matt Surface Picture

A PHOTOGRAPH submitted for publication was returned to me with a request for a clearer picture. As I no longer had the negative or more prints, I naturally wanted to fix the one returned so that it would pass inspection. It was accomplished in the following manner: I laid the print on a table and rubbed over it five coats of floor wax with a soft rag. Each coat was rubbed down lightly, but thoroughly. The last two coats I finished by rubbing the print upside down on a piece of blotting paper. This resulted in a high gloss print, bringing out the detail in the shadows so that it was accepted as a new print.—HENRY SIMON.

How to Straighten a Warped Drawing Board

IF a drawing board should warp in spite of the wooden battens on the back of it, it may be straightened as follows:

Paste strips of paper on the concave side of the warped board so that the paper strips are at right angles to the hollow. Also paste strips diagonally across these so that the board face is crossed and recrossed by strips of paper. Leave the strips on for a week and then wash off and it will be found that the board has regained its flat surface.

I have seen boards straightened in this way which were so badly warped that the paper pulled hard enough to start the glue holding the inset pieces on the back. The pull of the paper is not noticeable a few days after it is put on.

Winning an Athlete's Laurels

V.—Indoor jumping events

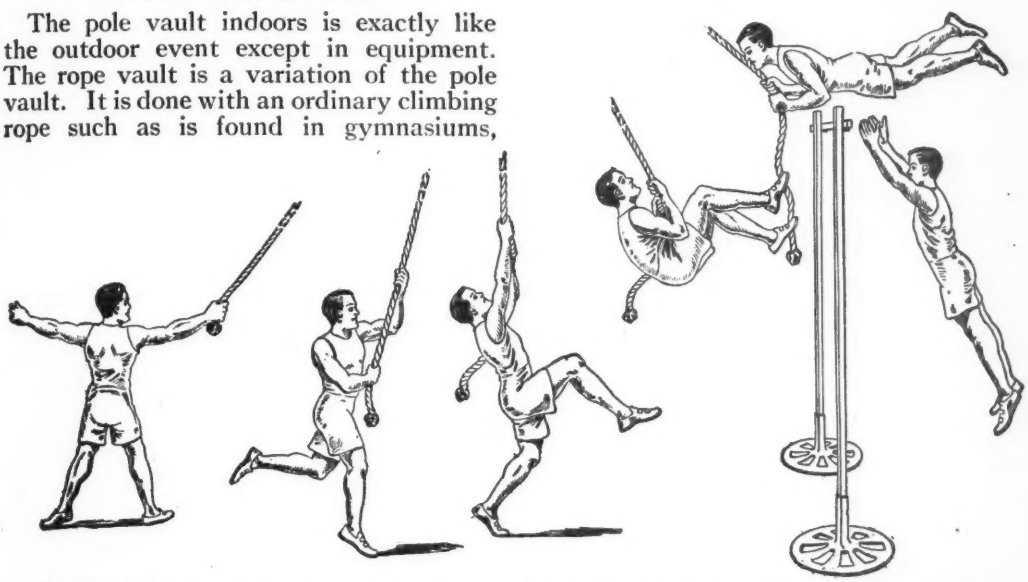
This article is the last one of a series of five. The other four will be found in the April, May, June, and July issues of 1917.

By Albert B. Wegener

THERE is no difference between indoor and outdoor jumping except in equipment. There is only one distinctive indoor jumping event. It is the running high jump with the spring-board, the highest point of which is not more than 20 in. from the floor. The jump is done in the same manner as the regular event and the rules of that event govern. The only weight event that is in general use indoors is the shot put. There is no difference between this and the outdoor event except that a leather-covered shot is used.

Indoor Vaulting Events

The pole vault indoors is exactly like the outdoor event except in equipment. The rope vault is a variation of the pole vault. It is done with an ordinary climbing rope such as is found in gymnasiums, suspended from the ceiling. It is a much safer event for beginners than the pole vault, for which it serves as good preliminary training.



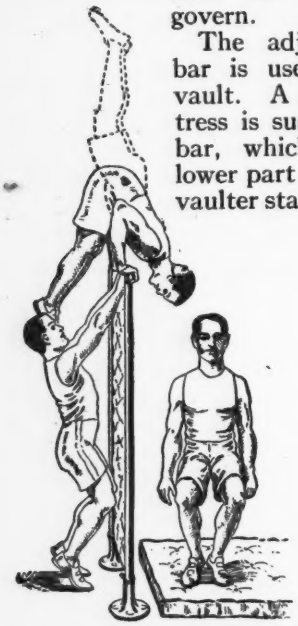
In the single run the vaulter grasps the end of the rope as far back as he can, runs forward and grasps the rope with both hands and completes the movement as in the pole vault

There are two good styles of rope vaulting, the single run, and the double run. In the single run the vaulter grasps the end of the rope as far back as he can, runs forward and grasps the rope with both hands about 6 in. above the head and completes the movement as in the pole vault. Some vaulters prefer not to make a turn in clearing the bar. The jump should be made before the rope comes to a vertical position during its forward swing. In the two-run style the vaulter grasps the rope, runs and swings forward until his chest almost touches the cross-bar, then swings and runs backward, then forward the second time and then vaults.

The rope may be of any length or thickness, suspended from the ceiling or beams. No assisting devices, such as knots or cross-bars, are allowed. The lower end of the rope is not higher than 18 in. from the floor. The jumping standards must be placed so that when the bar is 5 ft. from the floor the end of the taut rope will just touch it. Standards must not be moved from that spot. The lower hand may be shifted to, but not above, the upper, and the upper hand must not be moved after the start. Contestants must clear the bar at least on the second forward swing. The feet may be used in running forward and backward and in springing

from any spot, but they must not grasp the rope. Taking more than two swings constitutes a trial. In other respects the rules for the pole vault govern.

The adjustable vaulting bar is used for the fence vault. A gymnasium mattress is suspended from the bar, which serves as the lower part of the fence. The vaulter stands facing the bar, grasps it with hands about 8 in. apart and then springs and pulls upward to a bent position over the bar, with elbows firmly pressed against the trunk, hips well up, feet on the near side, and head on the far side of the bar. He then straightens his legs to a momentary bent-arm hand balance and then dismounts to the mat with a quarter turn.



A mattress hung on the bar for a fence

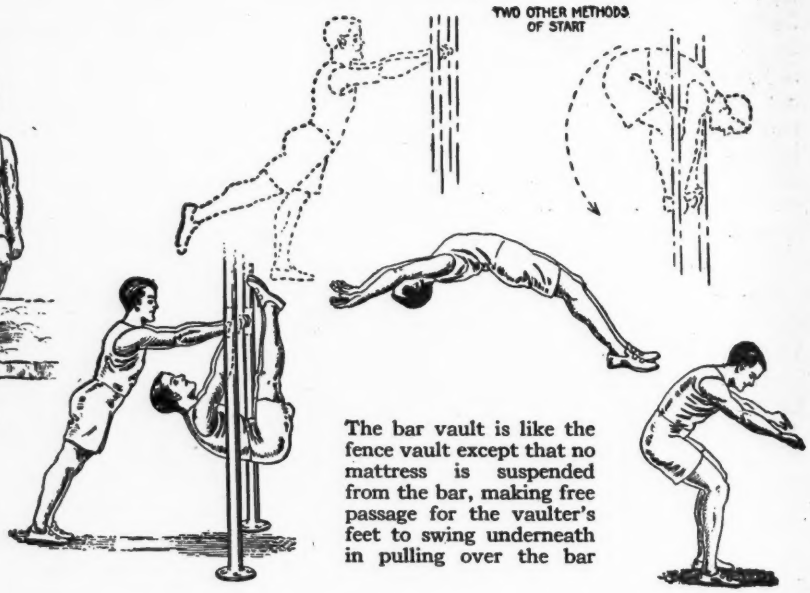
In making the spring, his feet must not leave the floor more than once. There must be no stop in the motion of the trunk until the floor is reached. No part of the person may touch the suspended mattress, and no part of the person, excepting the hands, shall touch the bar. The head must not be carried below the lower surface of the bar. In all other respects the rules governing the running high jump apply.

The one-hand fence vault is the same as the two-hand vault except for the obvious fact that only one hand is allowed on the bar.

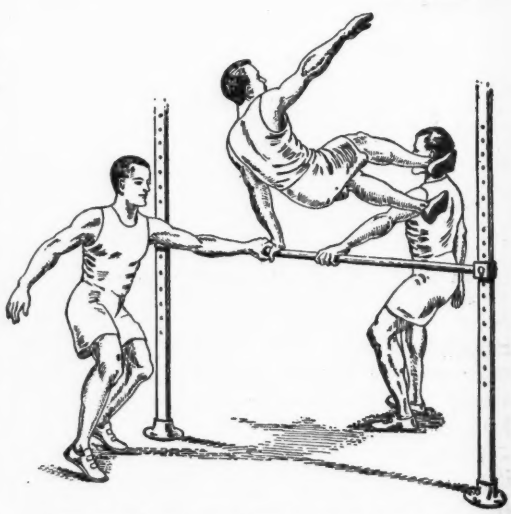
The bar vault is like the fence vault except that no mat is suspended from the bar. Thus the vaulter's feet may swing under the bar in the act of springing and pulling up over it.

The ring vault is done with the flying rings as follows: The under side of the rings in a hanging position must be not higher than 6 ft. 3 in. from the floor.

The jumping stands are placed in front of the rings in such a position that when the cross-bar is at 8 ft., the under part of the ring when stretched taut will just touch the top of the bar, and then the standards must be moved forward away from the rings 1 ft. At each additional



The bar vault is like the fence vault except that no mattress is suspended from the bar, making free passage for the vaulter's feet to swing underneath in pulling over the bar



Only one hand is allowed on the bar, but the vault is made like the two-hand vault

height to which the bar is raised the standards must be moved forward 6 in. The contestant must clear the bar on the second forward swing. He may use a run or jump at any time during these swings. Taking more than two swings constitutes a trial. In other respects the rules of the pole vault govern.

High Kicking Events

There are several styles of high kicking, but the only ones that are used in indoor meets are the scissors, the double, and the "hitch and kick." If a high kick is scheduled without specifying any particular style the contestants may use any style they wish. There is no rule as to how the kicker must alight except that he is not to be assisted. In other respects the rules of the running high jump govern.

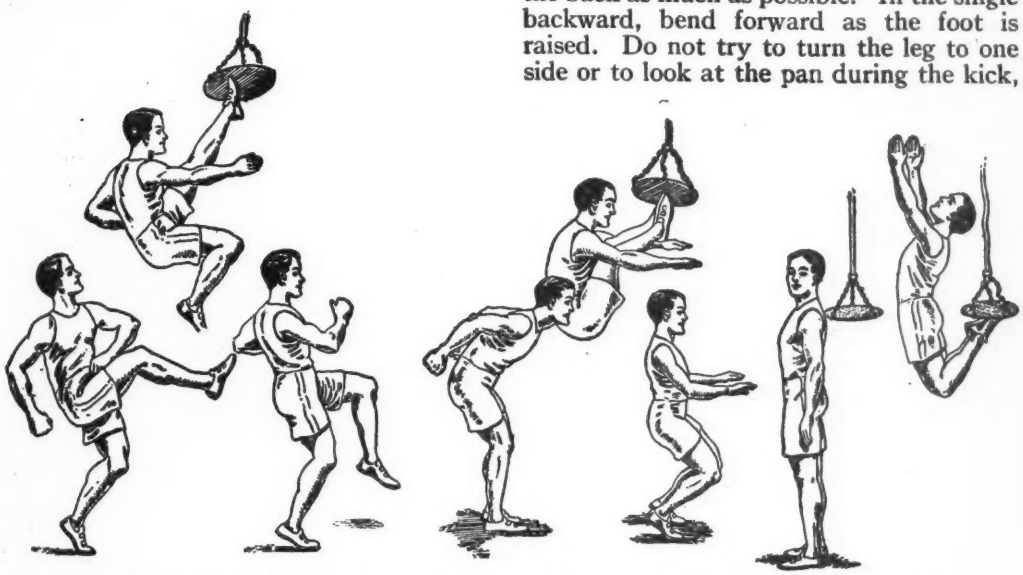
The scissors kick is the best style of kicking. In it the kicker jumps and kicks with the same foot and alights on the other foot. The approaching run should be made like that of the running high jump and the free leg should be used in giving a strong upward impetus.

In the double kick the kicker must jump from both feet and kick the pan with both at the same time. This requires a strong forward bend of the trunk. The legs should be raised with the knees bent sharply and spread outward.

With the hitch and kick the pan must be kicked with the jumping leg and the kicker must alight on the same foot and hop twice to demonstrate that he has his balance.

In kicking informally athletes are sometimes fond of doing the double backward, the single backward, the double forward jump and single kick, and the stretch kick.

In the double back kick the athlete should stand with his back touching the pan. After he jumps he should hollow the back as much as possible. In the single backward, bend forward as the foot is raised. Do not try to turn the leg to one side or to look at the pan during the kick, but raise the leg directly backward. In the stretch kick the kicker must keep one foot on the floor.



The kicker jumps and kicks with the same foot and alights on the other foot. In the second picture the kicker must jump from both feet. Some athletes like the double back kick as in the last picture

Miscellaneous Events

An ordinary gymnastic climbing rope is used for the rope climbing event. A tambourine or bell is fastened near the rope 18 ft. from the floor. The start is by pistol shot, and the time is taken from the flash to the touching of the bell or tambourine. The contestant sits on the floor, with thighs flexed and legs extended in front. He must not touch the floor with any part of his person after the pistol shot. Each contestant has three trials; the time of the best one is taken. The rope must not have any assisting devices, such as knots, balls, etc.

The best way to climb is "hand-over-hand," working the legs alternately up and down with knees bent. The knee should

be raised first and then the hand of the same side.

In gymnastic nomenclature the snap under the bar is called "short underswing for distance." It was first introduced as an athletic event by the author in 1900, and was later adopted by the A. L. N. A. Stand, grasp the vaulting bar, jump to a momentary free front rest, then drop backward as though about to start a backward free circle. At a point just below the bar, flex the thighs and then extend them forward; release the grasp, project yourself horizontally forward as high as the bar. Just before the feet strike the floor swing the arms forward to bring the body to an erect position.

Climbing rope to tambourine or bell

A regulation bar or an adjustable (in height) horizontal bar must be used. The height of the bar must be 4 ft. 9 in., measured from the top of the bar. The bar must not be raised or lowered. A line is drawn with the front edge extending from center to center of the uprights and directly beneath the horizontal bar. This is the scratch line, and all measurements must be made from the front edge of this line at right angles to the nearest mark made by any part of the person of the competitor.

The start is made with both feet on the floor back of the scratch line and the hands grasping the bar. Both feet must leave the floor at the same time and may not leave the floor more than once. The hands must be grasping the bar when the feet leave the floor. No part of the person of the athlete should touch the bar.

The author objects to the limitations of these rules that have been adopted by the A. L. N. A. It is far better to allow liberty in the preparatory position and movement just as in any other athletic event. Some athletes prefer to start in the standing position on the bar, and others from a stand on one foot with a free swing with the other.

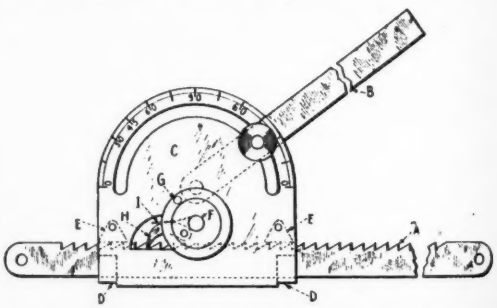
The snap under for height is an event listed by the A. L. N. A., and is not popular because of frequent injury to the forehead, due to striking the bar in the close pull-up.

(*The End.*)

Teeth of a Hack-Saw Blade Used for Spacing on Section Liner

THE gaging device for the liner is made of a 16-in. hack-saw blade, *A*, having 18 teeth to the inch. This is ground on the sides to remove all set, then the points are slightly rounded to remove the sharp corners. It is preferable to select a soft hack-saw blade as it can be straightened by hammering the edge at the proper place. The straight edge *B* is made of sheet steel ½ in. wide and 1/16 in. thick and is pivoted at one end in the center of a half circle *C* cut from No. 22-gage sheet bronze. The heel of this piece comes to the back edge of the saw-blade and a portion of each corner *D* is turned back and over the back edge of the saw-blade. A guide-block *E* is fastened to the gage piece *C* to keep it in place on the saw-blade.

The semi-circular edge of the spacing head has a slot, as shown, in which an adjusting thumb-nut is used to set the angle to the blade. The edge is marked in degrees so that this setting is easily accomplished. The spacing arrangement consists of a knurled wheel *F* which has a stop-pin *G* to limit the motion of the pawl *H*. A small spring *I* holds the pawl in the teeth of the saw-blade. A turn of the wheel forward and back moves the straight edge up to a new position, making the spacing perfectly uniform with the spacing set by the stop-pin.—C. S. BEARDSLEY.



The teeth of the blade being accurately cut, the spacing is made perfectly uniform

The Amateur Electrician

And Wireless Operator

Charging Storage Batteries With Direct Current

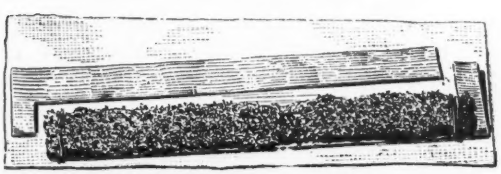
CONNECT six 110-volt, 32-candlepower, 100-watt carbon lamps parallel with each other and in series with the battery to be charged. This combination will approximately give the proper charging rate of 6 amperes. If the charging rate is to be increased, add lamps. If decreased take off lamps. To fully charge an empty battery leave it connected until each cell of battery gasses freely. Each cell should show a specific gravity ranging from 1,275 to 1,300.—EDWIN JASPER.

Simple Method of Making Storage Battery Cells

AN old type of storage cell reconstructed in an original and efficient manner is shown in the illustrations.

The battery plates are formed of strip lead and are separated by thin strips of rubber cut from a 10-cent sponge, which are held to the lead plates by small elastic bands. The plates are "formed" by the Planté process.

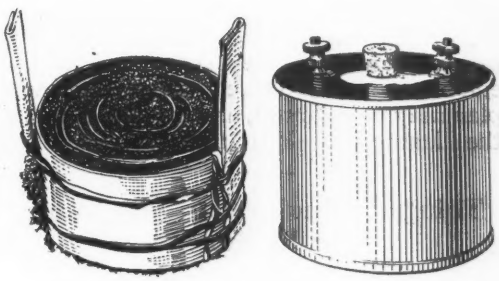
One of the illustrations in the next column shows very clearly how the

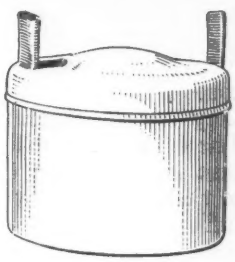


A detailed view showing how the lead plates are cut from one strip and separated by rubber

plates are assembled, while below it in the same picture is shown the celluloid jar or container, made from a 10-cent hair or puff box. The domed top of this box is slotted at opposite ends to permit the lugs to protrude.

A finished cell is shown in the upper right-hand corner of the picture, encased in a light aluminum cup. This view shows the rubber filler cap, in the center of the





The lead strips are made into a coil and set into a circular box, the domed top of which is slotted to permit the ends to protrude

celluloid cover, which is partly concealed under the ring of pitch that effectually seals the battery.

The first detailed view shows how the lead plates are cut from one strip of material about 3 by 30 in. It also gives a clear idea of how the sponge separators are attached.

The capacity of this little cell, which varies with the amount of active lead surface exposed, is very high for a given unit of weight, owing to the extreme lightness of the case, container, and separators employed in its construction. By leaving off the aluminum case, and at the same time perforating the lead plates throughout their entire surface, a very satisfactory high capacity cell of unusual lightness will result.—R. U. CLARK, 3rd.

How to make a Secure Joint in Copper Tubing

SINCE copper tubing is so useful in radio work, knowledge of how to make a neat and effective joint should be valuable. In building helices or spirals it is impossible to splice short pieces in the ordinary way. By tapping threads inside each of the abutting ends and inserting a short threaded piece of copper or brass rod to fit, as in Fig. 1, a perfect joint may be made. Where a wire extension from the end of the tube is desired, the same general plan may be followed, as shown in Fig. 2 of the illustration.—F. MAC MURPHY.

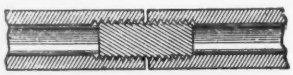


FIG.1

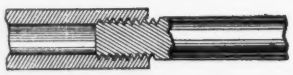


FIG.2

A threaded plug in the pipe ends for a close joint

Things to Know About Lubricants for Machinery

ALL machinery owners have had it drummed into them that only a good grade of mineral oil is fit for oiling their machinery; but there are a few extreme cases in which something else is used, and they are interesting enough to mention. The function of a lubricant is to supply a thin film between the sliding metal parts so that they do not touch each other with sufficient pressure to produce friction or heat or to cut one into the other, and to keep the sliding parts cool.

The "bearing pressure," or pressure of one part upon the other, determines to a great extent the kind or quality of lubricating oil to use; for with heavy pressure a poor or thin oil will squeeze out, or its film become broken down. Then the metal parts will rub and heating and cutting will begin, to the detriment of the machinery.

As a cooling medium, water will be found satisfactory. Where pressures are light and a flood or bath of water can be maintained without causing rusting, water is fully as satisfactory as oil and much cheaper, although the instances where it may be used are not many.

The garage man finds a great deal of trouble caused by carbon in the cylinders—pre-ignition, knocking, loss of power, etc. This carbon is considered a necessary evil, of no good whatever. But experience shows that a certain quantity of this carbon—not an excess—is as good a lubricant as may be found. For sleeve-valve motors it has been found that if a carbon deposit is in the grooves and creases of the sleeves no other lubrication is needed. This is easy to believe when we know that carbon is a constituent of mineral oil. Such a deposit is a form of graphite, which we know is self lubricating. Therefore it is a substitute for grease.

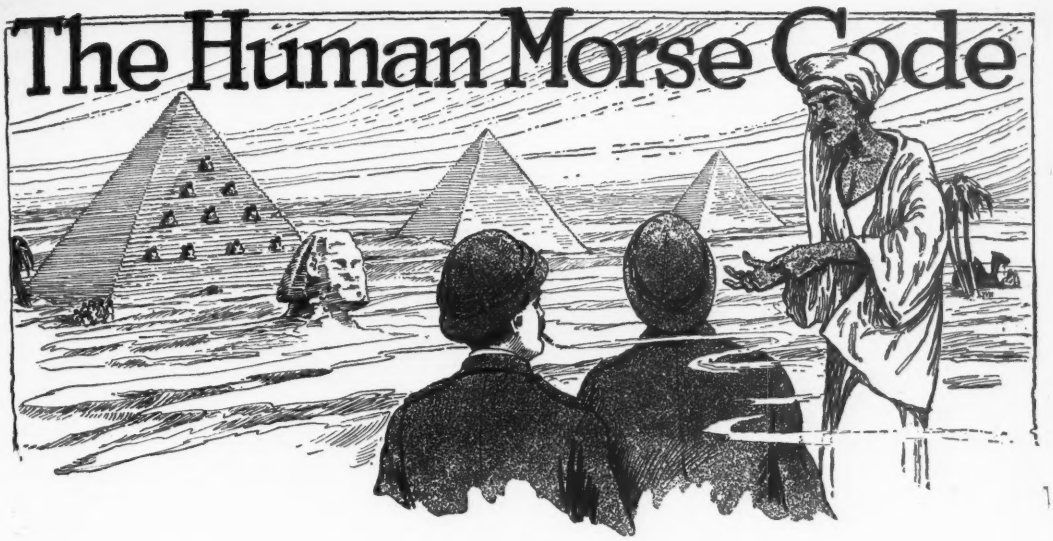
Pure glycerine is as good a lubricant as any oil if used where there is no great amount of heat. It will stand almost any ordinary bearing pressure and has a high viscosity rating. In plants manufacturing food products, bottling plants and breweries, compressed air is used extensively in contact with the products for various purposes, such as charging, filling, etc., and there is always a certain amount of the lubricant from the cylinder of the air-compressor that finds its way through the pipes and comes in contact with the product. In almost all cases this would be disastrous if ordinary lubricating oil were used, owing to the discoloring, the various chemical actions and the possible injury to health. But for this purpose glycerine is extensively used.

Fish oils, vegetable oils, animal oils and sometimes kerosene are used for such machinery. We find the various vegetable oils used on machinery in the preparation of products where a single drop of mineral oil on, or in, the product would be decidedly harmful.

Thus, for instance, a machine working on corn products is lubricated with corn oil and the operator is supplied with a squirt can filled with this oil. None of the vegetable or animal oils, however, is to be recommended for lubricating any metal surface. They are for use only in extreme cases where the bearing pressure is low. The bearings should be carefully attended to and watched.

A mixture of lard oil and kerosene will make a sufficiently free-running journal and is often used on hand-operated feed tables of machines. When freshly applied it gives a free and easy sliding fit to roller-bearings, but owing to the evaporation of the kerosene and the gumming quality of the lard oil, it must be renewed and freshened up frequently. Soap is the best lubricant to use on wood, and soapy water makes the best lubricant for rubber surfaces.

The Human Morse Code



IN an article by R. G. Micklam in the Wireless World recently an interesting simplified method of committing to memory the Morse Code by the use of a succession of what may be termed mnemonic groups was given. He takes us on a mental trip to Egypt, where we seat ourselves directly in front of the Pyramid of Cheops. We note, as we do so, a group of Arabs standing by, who have evidently received a radiogram from England apprising them of our advent, for no sooner are we comfortably seated than they race away and begin scrambling up the face of this 6,000-year-old monument. Having reached their appointed places, they squat down simultaneously, clasping their arms around their shins and sinking their chins on their knees, so that they appear to us, some 500 ft. away, like a collection of glorified full-stops, their blue *galabiehs* forming a pleasing contrast against the light brown ridges of the pyramid. We notice, too, that they have arranged themselves in a symmetrical group, as in Fig. 1, and we turn to a Dragoman standing by to ask what this figure may mean. He tells us that the Arabs take us for mere tourists (Pshaw!) and want to earn "*backsheesh*." Well, nobody begrudges an honest man a mouthful of bread; on the other hand, by quite a happy coincidence the Arabic word for bread is "*eish*" and these cunning fellows have so grouped themselves as to portray in Morse Code the four letters composing that word, since one dot (.) represents the letter E, two dots (. .) represent I, three dots (. . .) S and four dots H, and if this is how we are to learn the Morse alphabet, it promises to be quite a simple matter.

The second evolution appears to be the preliminary to a precipitate roll down the oblique face of the pyramid, as the six men composing the three upper groups suddenly straighten themselves out, as in Fig. 2, and we are on the point of wirelessing to beg them not on any account to break their Egyptian necks for the mere gratification of our unworthy selves, when we are given to understand they threaten nothing more violent or deadly than the representation of three further code letters, the topmost man now describing himself as a T (—), the

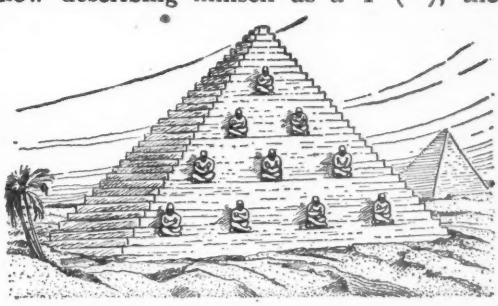


Fig. 1. The Arabic word for bread "eish" spelled out with human figures

second two making out that they represent M (— —), while the third group aver it is *they* not *we* who should be surprised, since they collectively represent O! (— — —). On learning this, however, we begin to feel just a trifle uneasy in our minds, for it can hardly have been a second coincidence that, by a combination of the two groupings, the word "*eishtmo*," should have been spelt,

which is the Arabic equivalent for "insult him." If these saucy sons of Ham are laughing up their sleeves at us, they will not get their mouthful of "*eish*" after all. And yet what recks it? We are not out for

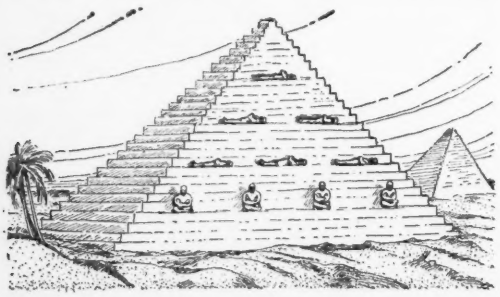


Fig. 2. The combination of the first spelling and this makes "eishtmo," Arabic for "insult him"

intellectual recreation and have the satisfaction of memorizing in these two groups no less than seven letters of the Morse alphabet.

The Arabs now call upon several more of their sun-scorched brethren to join them, and, thus reinforced, proceed to entertain us with a third grouping, a picturesque one withal, for we here get a combined figure of squatting and prone Egyptians, as in Fig. 3, which is certainly not a complicated figure, yet it helps us to tuck away in the recesses of our brain boxes six more letters, namely:

(A) .— (U) . . — (V) . . . —
(N) —. (D) — . . (B) — . . .

Happily these form no equivocal word in Arabic so we conclude we have been entertaining unworthy suspicions of our desert

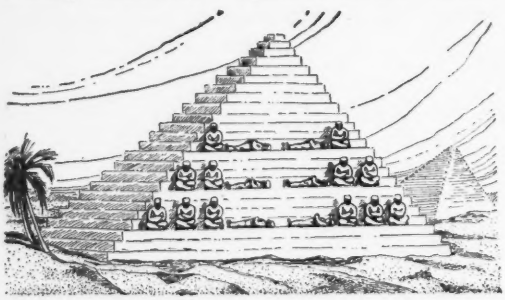


Fig. 3. Positions of the men for making A, U, V, N, D, and B in the Morse code

friends. While we are mentally registering the six symbols, however, the top two sets of men begin quarreling and approach each other in a menacing attitude; but as we are at the safe distance of 500 ft. from the seat of disturbance, we content ourselves with merely adding another letter to the tablets of our memories, for the conjunction of the two opposing factions represents the letter P (. — — .). Meanwhile the two couples commence stealthily to maneuver round one another, so that, although they began thus . — — . they presently stand thus — . . — which may be all quite fortuitous, of course, still we manage to profit by the chance grouping, since — . . — is X.

Do we realize that we are already considerably more than half way through the alphabet? Not without casualties, however; for in the fracas above alluded to three men are injured: the first is therefore gently laid down, a dark visaged brother sits at his head, fanning him with the tail end of his robe, while another sits at the injured man's feet and tickles his toes with a spike of camel grass. We simply cannot resist the temptation to place another letter in our mental warehouse—viz., R (.—.) for the three men are now grouped thus.

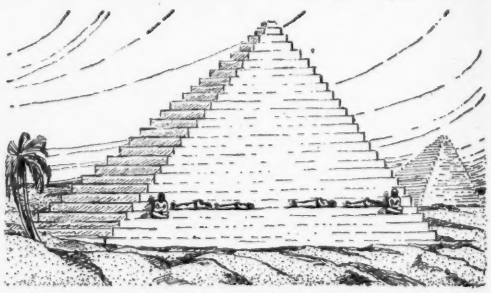


Fig. 4. The men take their places as shown which in the Morse code is W G

The two other wounded fellows call out faintly for "water," so they are likewise tenderly laid out, head to head, and one of the onlookers sits between them, giving each alternately a sip of water out of his inverted tarboosh, hastily filled from the pump of Mena House Hotel close by; thus the group becomes —.— and as it must be a hopelessly diseased wind that cannot manage to blow somebody some good somehow, we so far take advantage of the woes of these two unhappy wretches as to add the letter K to our rapidly growing Morse alphabet, thereby accounting for 17 out of the 26 letters.

Another group composed of six men evolves itself as in Fig. 4, but the component parts thereof immediately begin a 120-deg.-in-the-shade argument. As far as our obliging Dragoman is able to make out from this distance and the echoes thrown back from the face of the pyramid, they are talking about cricket, and the left three

cannot convince the right trio that "W.G." was the greatest cricketer the world has ever known. We, having no doubts about

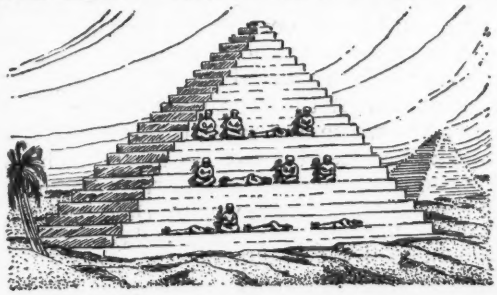


Fig. 5. Three more letters of the alphabet spelled out by the men; these are F, L, Y

the fact, take the chance of identifying the late champion with the Morse initials, though he would not have thought we knew much about cricket if we had only allowed him four stumps and two balls (. — — — — .) for a country match.

The pantomine is here rudely interrupted by the sound of a buzzing airship propeller, and, looking up, we descry a beautiful monoplane gracefully winging its way, heading straight for the summit of our pyramid, behind which it presently disappears. We remember this is the French aviator, *De Vol Plane*, attempting to win the £5,000 prize by making a circuit of the world, upside down, without descending once for gasoline, but in the midst of our speculations as to his chances of success we are recalled to the business in hand by a sudden shuffle on the part of our acrobatic friends. They have forgotten their cricket controversy and hastily thrown themselves into a curious group, as in Fig. 5, which seems to us just a horrid jumble of people, until Mr. Know-all, our Dragoman, ex-

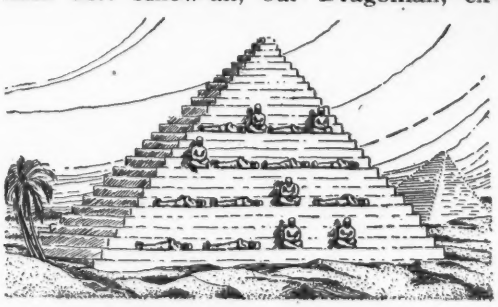


Fig. 6. The alphabet is completed by a quadruple group of men representing C, J, Q, Z

plains that the group represents the three letters F L Y, which is appropriate enough under the circumstances, as we feel bound to admit. So we add those letters to our list.

Our dusky entertainers now complete the alphabet with a quadruple group, for which, to our chagrin, we are able to find no mnemonic peg whatever (Fig. 6), but which we are told represents the four letters C J Q Z, and I defy any man to make anything approaching an intelligible word out of that.

I conclude this article by drawing attention to a very curious fact in connection with the Morse Code—viz., that in distributing his symbols over the alphabet, Mr. Morse did not, in many cases, allocate

Table or chart showing the distribution of Morse signals and their ideal allocation

the shortest symbols to the most frequently used letters, the amount of divergence from the ideal distribution being shown in the diagram above.

Counting the dot as 1 and the dash as 3, we get a specific time-value for each Morse signal, and it will be seen that column four of the diagram represents the correct progressive order of the ideal Morse alphabet, beginning with a single dot valued at 1 and ending with a symbol composed of a dot and three dashes valued at 7. Thus the letter E, which is by far the

most used letter in the alphabet, is rightly given the shortest Morse signal; T being the next letter in order of frequency is awarded the next shortest signal, and so on, until we find Z, the least employed letter, deservedly saddled for its laziness with one of the longest Morse signals.

But by Mr. Morse's allocation of English letters, as will be seen on reference to column five of the diagram, only 14 out of the 26 letters are correctly suited. This means great loss of time in transmission. It may be observed in this connection that the Morse code is in use on no less than 95

inconvenient locations, especially in crowded cities where the shed or "shop" is likely to be next to an alley fence or in a similarly exposed place.

In our usual thoughtless following after precedent we are likely to believe that the standard grounding joint customarily employed by telephone and electric lighting companies is about the only grounding joint possible. Consequently every time the ground wire gets stripped off its pipe, we replace it with another of exactly the same sort. This usual grounding joint is shown in the illustration. It consists simply of the groundwire wrapped several times around the pipe that goes down into the earth, the turns being held in place by occasional dabs of solder. Naturally this arrangement is not very strong mechanically.

A more satisfactory joint can be made as follows: Take a round file and brighten up the interior of the pipe at the end; then wet some waste and tamp it down into the pipe a distance of about 1¼ in. Bunch up the end of the ground wire until it fills most of the space above the waste; then heat the end of the pipe and the bunched-up wire with a soldering torch, at the same time applying a little soldering paste, in order that the solder to come may stick easily. When the end of the pipe becomes hot enough to take the solder readily, apply enough of that material to completely fill the end. This process will naturally entirely submerge the bunched-up wire. With a cloth, round off the upper surface of the solder while it is still warm, until it forms a neat cone, with the ground wire coming out of the center as shown in the illustration.

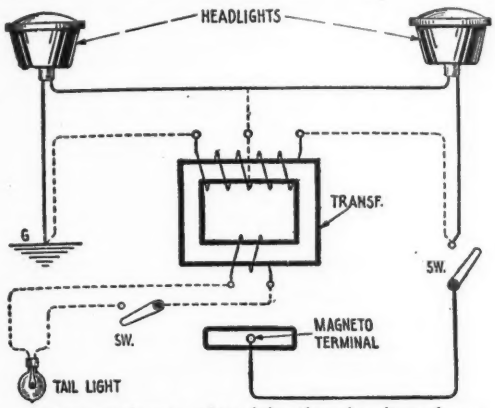
This sort of a ground connection buries the end of the wire inside the pipe, instead of causing it to cling to the exterior as best it can, as with the old way. The end of the pipe may be subjected to very rough treatment indeed, without disturbing the wire.

Auto-Transformer in Headlight Circuit on a Magneto

HEADLIGHTS from the Ford magneto are so wired that when one of them burns out the circuit is broken and the other one goes out. This trouble may be easily overcome by the use of a small auto-transformer. Such a transformer may be made in a rectangular form from thin strips of sheet iron ½ in. wide, cut in lengths to make four piles 1 in. high, two of which are 1½ in. long and the other two 2½ in. long. These are all given a coat of shellac varnish and allowed to dry; then they are built up in dovetail fashion after the coils are placed on one of them.

Make two coils of 120 turns each, using No. 20-gage wire—about ½ lb. will be required. The method of placing the coils on the core and the necessary wiring are illustrated. Should the device fail to work satisfactorily, reverse the connections of the coils. With this outfit, the burning out of one headlight will not cause any perceptible change in the light from the other. It is also possible by winding another coil on

the core, to get a low voltage from the magneto for the dash or tail lights. Use No. 20-gage wire for this also, and the number of turns should be equal to the voltage

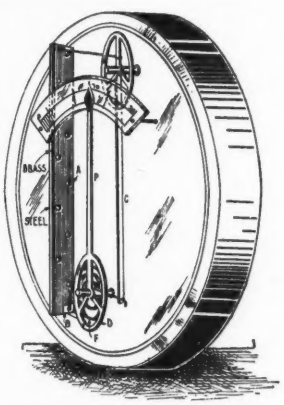


Auto-transformer placed in the circuit to keep one light burning after the other burns out

required by the lights, multiplied by 17. The wiring for this is also shown in the diagram.—CLAUDE SCHUDDER.

Constructing a Thermostat to Regulate Furnace Heat

IT is not always necessary, but is a convenience to have a thermostat for regulating furnace heat. These instruments can be purchased at a nominal price; but one simple in construction can be made that will serve the purpose. Its working is based on the expansion of metals. The difference in the expansion of steel and brass is considerable. If thin strips of these two metals be firmly riveted together the rising temperature will cause them to bend, with the steel on the inside of the curve thus formed. This is due to the fact that brass expands twice as fast as steel.



The unequal rate of expansion of the metals causes the hand to move

The accompanying illustration is almost self-explanatory. The two metals riveted together are shown at *A*, fastened to a block *B*. The short end of the lever *C* is connected at the other end of the metals by means of a silk thread, the long end being connected with the balance wheel *D* in a similar manner, the thread being given a few turns around the axle before it is fastened to a spoke. The pointer *P* is attached to the balance wheel and moves over a scale. The spring *F* is to return the pointer to its lowest reading.

Under varying temperature the pointer will assume various positions on the scale, which must be calibrated from a standard thermometer. It is only necessary to mark the scale between the temperatures required for its action—from 60 to 80 deg. for a furnace.

To calibrate accurately it will be necessary to place a thermometer close to the instrument and adjust the pointer to the center of the scale when the temperature is at 70 deg. A mark is made on the scale. As the temperature changes, make the markings read in degrees on the scale.

By placing electric contacts on the pointer and also at knobs on the scale the thermostat may be used to operate electric control devices.

The steel and brass strips measure 3⅛ in. long by ½ in. wide. Each piece should be approximately .024 in. thick. Use small copper rivets for fastening them together. The wheels shown were taken from an old clock, which with their shafts and bearings made a fine working instrument. The old case was used also and cover plates put on to make a neat finish.—O. B. HANSON.

An Inexpensive Multi-Point Loading Coil

NEARLY every amateur wireless enthusiast has in his possession, or may readily obtain, the necessary materials for the construction of this loading coil. It is mounted in a box, which has a base 12 in. square and is 4 in. deep. The base of the box (the face of the mounted coil) is made of a single board. The knob *K* is the end of a ribbon spool about 2 in. in diameter and ½ in. thick. It is to be sandpapered and painted black, in imitation of hard rubber. For contacts, paper fasteners are used.

For coils, there is required about 1300 ft. of magnet wire. The number of coils is 50, each being 3 in. in diameter. For the rotary switch blade a piece of thin sheet brass is used, and for binding posts two carbon terminals of worn-out dry cells were taken.

The center of the base must be determined and a 10-in. circle drawn. With a compass set at ⅜ in. from point to pencil, and starting from the top of the circle, twenty-five points are to be established on each side of the starting point, making fifty points in all, and each ⅜-in. distant from the next adjoining. Holes ⅛ in. in diameter are bored at each of these points, and at each of the lower corners. The box is

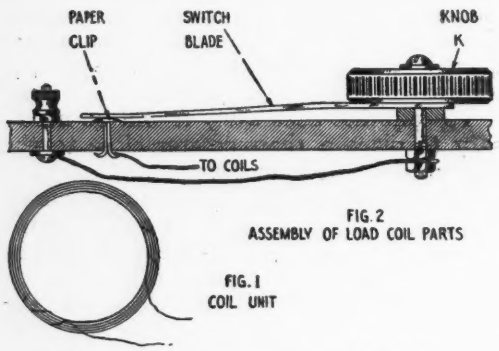


FIG. 2
ASSEMBLY OF LOAD COIL PARTS

FIG. 1
COIL UNIT

Lever with its connections and knob for making contact with clips and the coils

then sand-papered and painted black.

When the box is dry the fifty paper fasteners are inserted in holes on the circle, and the binding posts are placed in the holes in the lower corners. The switch blade is shaped and placed as illustrated in Fig. 2. To facilitate the work of wiring, the baseboard is removed. The blade is electrically connected with the lower right-hand binding post with insulated wire having sufficient slack so as not to hamper the movement of the switch blade.

Fifty small coils, as shown in Fig. 1, each having 25 turns 3 in. in diameter, are now made. One of these is connected between each pair of paper-fastener switch buttons, on the reverse side of base. That is, one end of the first coil is connected with the left-hand binding post, and the other end of the coil with the lowermost switchpoint on the left side of the circle. To this point is also attached one end of the second small coil, the other end of that coil being attached to the adjacent or second switchpoint. The remaining coils are similarly employed to successively connect adjacent points until a complete circuit is established around the arc to the last switchpoint on the right, which is, however, not connected with the binding post on that side.

The wires are secured to switchpoints by taking two turns around the prongs or points of paper fasteners and then bending over the prongs, as is done when papers are bound together. The base is then screwed in place. All the wiring has been done on its reverse side.

The loading coil is placed in the circuit by connecting the aerial wire with right-hand binding post on the face of the base, while the primary of an inductive coupler is connected with the left-hand binding post.

For testing, a dry cell may be connected in series with a telephone across the binding posts. When the switchblade is revolved, a click should be obtained at each of the fifty contact points. Should the click not be obtained at any point, the connections at that point should be examined and firmly secured, or the small coil should be examined to see that the magnet wire is not broken.

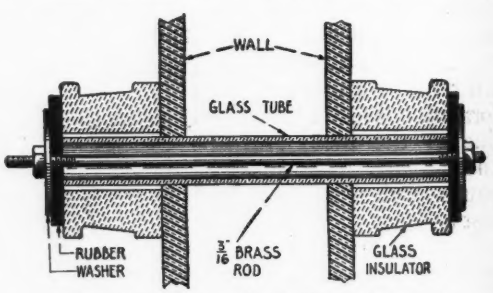
A coil made as described has been in constant use and has operated satisfactorily.—CHARLES E. KALBACH.

A Coating to Make a Battery-Box Acid Proof

MELT together in an iron kettle 8 parts of wood tar and 14 parts of resin, and then stir in 10 parts of finely powdered brick dust. Apply this solution warm to the battery-box, after it has been well cleaned and sandpapered.—EDWIN JASPER.

A Water-Gage Glass Used for a Lead-in Insulator

THE diagram shows how a wall insulator may be made by combining a length of steam boiler water-gage glass with two



Glass insulators and a boiler water-gage glass used for a lead-in insulator

old lighting cable insulators. A piece of No. 6 wire may be substituted for the brass rod. If the glass tube is shortened, ordinary porcelain insulators may be used with good results.—ODIS REYNOLDS.

Wireless Work In Wartime

V.—How to secure practice in working through interference

By John L. Hogan, Jr.

THE closing portion of the November article in this series was devoted to a brief discussion of the problem of reducing interference in radio telegraphy. Of the two general types of interference which exist, we may first consider that which arises from the overlapping of radio waves when several nearby stations are transmitting at the same time. This is of considerable importance, and, since its reduction depends largely upon the training of the operators, we will do well to study it at this point. The other sort of interference, which is set up by natural or non-radio electrical disturbances, can be most effectively considered after the apparatus used in radio telegraphy has been studied in further detail.

For the present, then, let us take up the matter of "station interference," as it is called. It is not hard to see how such difficulties come up, if we remember that each radio transmitter sends its signal waves in all directions with approximately equal strength, and that all normal radio receivers absorb signal waves with equal ease regardless of the direction from which they come. Suppose that two radio transmitters of equal power are located at Philadelphia and at Norfolk, and that both are sending at the same time. A receiving station at New York will have little difficulty in deciphering the signals from Philadelphia, since the distance is so much shorter than that between Norfolk and New York that the messages from Philadelphia will be much louder than those from Norfolk. By the mere increased strength or intensity of the signals from Philadelphia, it is easy to distinguish them from the Norfolk signals. But suppose that a receiving station at Washington wishes to copy the message which Philadelphia is sending. Since the distance from Washington to Norfolk is about the same as that from Washington to Philadelphia, the two sets of signals will be heard simultaneously and with about the same degree of loudness. Clearly, since loudness alone is no longer sufficient to permit the receiving operator (at Washington) to distinguish between the two sending stations, some other difference between them must be relied upon.

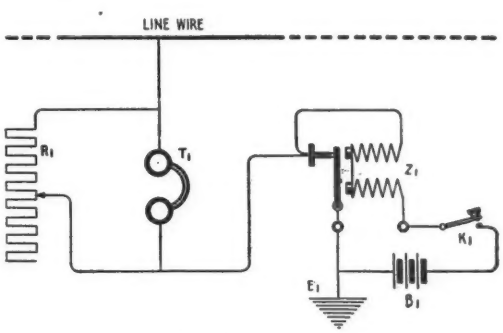


Fig. 17. Each signal station of the buzzer telegraph line is connected as shown

Wavelength and Tone Frequency

There are two characteristics, in addition to loudness, which are commonly used to separate desired from undesired signal waves. The first of these, wavelength or wave-frequency, will be considered in detail later in this series of articles. At present it will be sufficient to note that when several different transmitters use several different wavelengths, the effect at a receiver is almost as though each sending station were operating over a separate wire. A rough idea of the effect of changing wavelength may be had by considering the approximately parallel condition in which several different wires connect four line telegraph stations *A*, *B*, *C*, and *D*. Stations *A* and *B* may communicate with each other on one wire while stations *C* and *D* are also working together on a second connection, and there will be no mutual interference. The selection of the wire which is not "busy," as the telephone engineers say, must be made by trial; and the actual connection is made by "plugging in" to a terminal board to which the several wire lines lead. The analogous wireless or radio case provides several separate channels of communication between the four stations, and each channel is termed a "wavelength." Stations *A* and *C* may intercommunicate on one wavelength while stations *B* and *D* signal each other on a second wavelength. without mutual inter-

ference. The selection of the free wavelengths, on which no interference exists at the time, is made by trial; and the actual adjustment which limits the transmitters and receivers to certain definite wavelengths is made by control of parts of the apparatus according to the process generally known as "tuning." The proper use of these various wavelength channels of radio communication will be taken up later, when the limitations of tuning or wavelength selection will be pointed out.

In addition to selection by wavelength, the characteristic of tone frequency or spark sound is used to discriminate between the signals of several stations which are heard at the same time. If a pair of senders of equal power are about the same distance from some receiving station, and if both transmitters use the same wavelength, under normal conditions their signals will be heard with about the same intensity. If, now, these two signals sound alike, it will not be possible for the operator to distinguish between them. However, if the dots and dashes from one sender are heard as an intermittent rough, low-frequency sound, and if the signals from the second are high and musical in character, it is easy to see that the receiver can concentrate on either and decipher its messages without being disturbed by the other station. The condition is comparable to that in which a fife and drum corps is heard in the distance; it is easy to count the strokes on the bass drums without noticing the fifes at all, or to note the air played by the fifes without being disturbed by the booming, deep sounds of the drums.

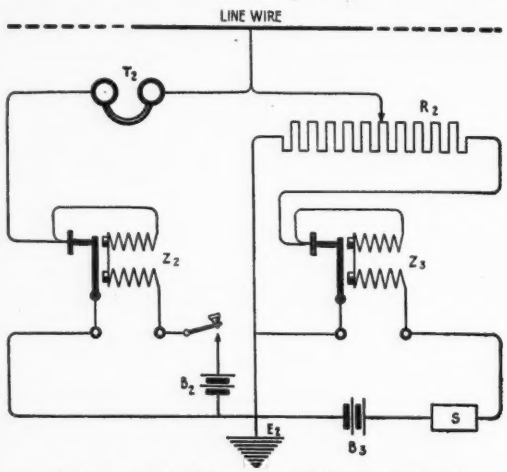


Fig. 18. At left is the ordinary type of buzzer outfit connected as in Fig. 17, and at right is the interference-maker

Practice in Concentration

Skill in reducing station interference by tone selection is mainly the result of operating practice. How well the man in charge of a receiving station can concentrate on the signals produced by some given transmitter from which he wishes to receive, while he at the same time disregards other signals or other tones which are present in his telephones at the same time, depends almost entirely on his experience. This is one of the most important qualities which an operator can develop, and it is worthy of much practice.

Fortunately enough, practice in tone-selection for reading messages through station interference can easily be carried on without wireless apparatus. It is only necessary to make use of the buzzer telegraph line described in the earlier articles of this series. For the period of the war it is not permissible for experimenters or others to use wireless apparatus without specific permission from the Navy Department; nevertheless, many of the branches of radio operating can be covered thoroughly by using the instruments which have been and are to be explained in this series. Thus it becomes possible to learn the most difficult and perhaps the most important parts of wireless operating without experiencing any difficulties on account of the present embargo on radio experimenting.

The Buzzer Telegraph Line

If you have not yet arranged with a friend for building and operating a buzzer telegraph line, you should do so at once. Study by oneself is practicable in beginning operating and for certain later divisions of the work, but it is almost impossible to get the practice which is so essential unless several students cooperate in the use of a buzzer telegraph line. The best plan is to have at least three stations, in three nearby houses, connected by wire as explained in the October article. If you cannot arrange for this, set up two or three stations in as many different rooms of your own house, and connect them by wire in the way described. Then, by inviting one or two companions to work with you, you can all secure the practice which is so needful to the ambitious radio man.

In working with a three-station line it

will be noted that the buzzer-sounds from each of the three stations possess a certain individuality, and that the identity of a sending station can be established even before the operator has given his station call, merely by noting the signal-tone character. If three of the same make or model of buzzers are used, the tones may sound very much alike, and it may be difficult to tell by tone which station is sending. If three different sizes or types are used, however, the signal tones are likely to be widely different. It is this variation in signal tone which makes possible the reduction of station interference by the operator's concentration on the sounds themselves.

Fig. 17 shows a signal station of the buzzer telegraph line. The buzzer Z_1 has the telegraph key K_1 and battery B_1 connected across its binding posts, so that when the key is pressed the buzzer will operate. The left-hand binding post, which is connected with the vibrating armature, is made fast to the earth connection; and the contact-adjustment post is connected with the line wire through a pair of head-telephones of approximately 1000-ohms resistance. These telephones may be shunted by a variable resistance of about the same value, for the purpose of weakening the signals heard. The resistance is not usually necessary, however. The line wire may be extended in either direction to reach as many stations as desired, within reasonable limits of number and distance. Each station is connected as shown in Fig. 17, and the system is such that signals produced by pressing the key at any station are heard simultaneously in the telephones at all the other stations.

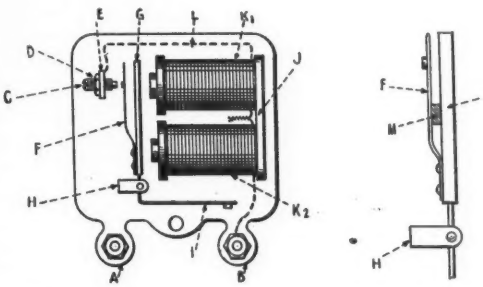


Fig. 19 and 20. A typical buzzer of the iron frame type and a method of adjustment

Using One Station to Make Interference

Obviously, such a system resembles a group of radio stations in many particulars. If there are more than two stations on the line, it is possible to arrange for one of them to interfere while the others are attempting to exchange messages. By choosing the buzzer pitch of the interfering station so that it is different from that of the sending station, the easiest interference condition is created. By gradually adjusting the interfering note to a sound closer and closer to that of the sending station, the difficulty of receiving is continually increased and practice in concentrating on one note to the exclusion of others is secured.

A better way to develop systematically the power to eliminate or reduce station interference by tone selection is to install at one of the buzzer-telegraph line stations an equipment such as shown in Fig. 18. Here the left-hand portion represents the usual buzzer sending and receiving outfit, connected as in Fig. 17. The telephone shunting resistance is not shown, but may be added if found necessary. The right-hand portion of the diagram shows the interference maker, which consists mainly of a second buzzer Z_3 having its own battery B_3 and a sending key or sending machine S connected across its terminals. From the contact-adjustment post to the left-hand (armature) binding post is connected a high resistance R_2, which should have a value of at least 1000 ohms. A sliding contact on this resistance is connected with the line wire.

This interference-maker will produce interference signals whose strength, tone and occurrence are under control, and may be arranged so as to operate automatically. When first set up, it will be noticed almost immediately that sliding the contact along R_2 changes the strength of the interfering signal at all the stations on the line, and that the more resistance is cut-in between the line wire and the ground, the louder the signals are. In practicing, it is a good plan to start with fairly weak interfering signals, and then gradually to increase their strength until they are as loud as or louder than the messages it is desired to receive.

Varying the Tone of the Buzzer

The adjustment of the interfering or sending signal tone has been mentioned several times, but specific methods of making this adjustment have not been shown. In Fig. 19 a typical buzzer of the iron-frame type is illustrated. This is useful for this sort of work because of its cheapness and reliability. The mechanical arrangements vary in detail according to

the make of instrument, but all have an armature *G* which carries a contact-spring *F* and is mounted to vibrate before the poles of the electromagnets K_1K_2. The contact-spring *F* normally presses against the tip of the contact-screw *C*, which is supported by the contact-adjustment post *E* and held in place by the lock-nut *D*. The

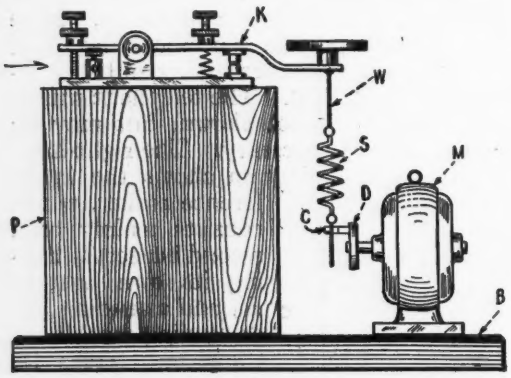


Fig. 21. An automatic sender made with a motor having a crank and pin on its shaft

electrical circuit is usually from the binding post *A* through the iron frame *L* and pivot *H* (or its equivalent armature-support) to the armature *H* and contact-spring *F*, thence through the contact-screw *C* and down its post *E* (which is insulated from the iron frame), from there by way of a wire to the magnet coils, through them and finally out at the insulated binding post *B*. The greatest control of the buzzer tone is normally secured by varying the number of battery cells used to operate it, and by changing the adjustment of the screw *C*. Where a pivoted armature is supplied, adjustment of the spring *I* will permit further variation in pitch or character.

The buzzers of the iron frame class, and even the small nickel-plated types, usually have tones which are low compared with those in common use at radio stations. Practice on the high tones. For this purpose, either install special high-frequency buzzers which may be purchased for about $2.00 each, or adjust the cheap buzzer to produce a high tone. One way of making such adjustment is shown in Fig. 20, where *M* represents a bit of folded paper or a soft wooden wedge pressed in between the armature *G* and the contact-spring *F*. A little experimenting with the thickness of wedge, the setting of the contact-screw and the strength of battery will usually result in a clear high tone much like that of the modern radio stations. The standard tone of 1000 sparks per second seems to be of approximately the same pitch as the second *C* above middle *C* on the musical scale, and the adjustment of your high-frequency buzzer may easily be verified by comparing it with a piano.

Use of the Sending Machine

The sending-machine *S* of Fig. 18 controls the occurrence of the interfering signals, by stopping and starting the buzzer Z_3. At first it is a good plan to run the buzzer continuously, in one long "dash," so that the interfering noise will be heard constantly. An experiment will show, however, that interference which stops and starts is more difficult to overcome than the steady-dash variety. Consequently your practice should be directed toward the kind which comes and goes, so that you will be prepared for the worst when you get into actual radio operating. The best way to get an imitation of bad station interference is to connect your automatic sender, of the tape or disk types described in the October article, at *S*; if you have no automatic sender, you can sometimes persuade a friend to take the interference key and make irregular dots and dashes for you.

A sending key *K*, Fig. 21, mounted on a pedestal *P* and base *B* and connected with a clock-work or electric motor *M* will serve for use at *S* in Fig. 18. By attaching a wire *W* and a spiral spring *S* between the key lever and a crank-pin *C* mounted on a disk *D* on the motor shaft, as shown in Fig. 21, an automatic sender of dots or dashes can easily be made. By varying the speed of the motor, as well as the adjustment of the key, the length of dot, dash or space can be adjusted to suit.

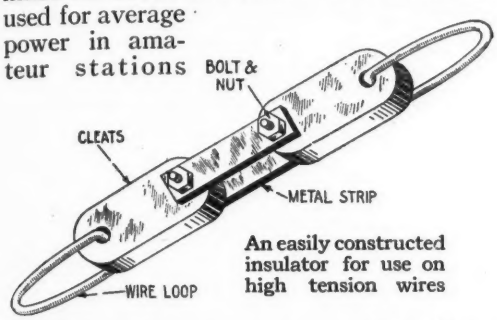
Those who have no electric motor available for use, may, of course, use a motor which is spring driven, instead. An old phonograph motor would be just the thing. Still another scheme would be to use your omnigraph to replace the key and motor arrangement.

The equipment described this month is sufficient to permit code practice, as well as extensive practice in reducing station interference by concentration. Future articles will take up static interference, and the adjustment of the radio apparatus itself so as to minimize the difficulties.

(*To be continued*)

An Easily Constructed High Tension Insulator

THE drawing below shows a high tension insulator that is easily made, has good strength and insulation, and is businesslike in appearance. It can be made for about five cents. Two cleats are used for average power in amateur stations



An easily constructed insulator for use on high tension wires

while three or more can be used for others of greater potential. The cleats are joined with ⅛-in. iron or brass strips fastened with small bolts as shown in the sketch. For good appearance all the metal parts should be enameled black, while the porcelain can be covered with thick shellac, giving it the appearance of brown glaze.—JOHN B. RAKOSKI.

Heating Hard Sheet Ruober to Facilitate Cutting Disks

THE amateur experimenter and worker on electrical apparatus at some time or other desires to cut hard sheet rubber into round disks for making Wimshurst machines or other devices. Hard rubber, as received from the stock house, is very difficult to cut, unless you have all the facilities for doing such work.

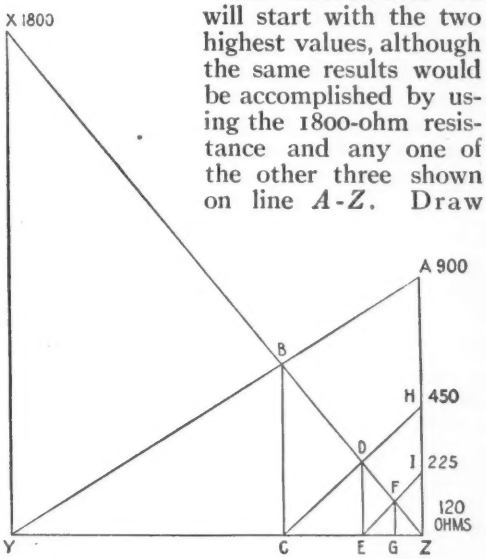
The writer has found a very easy way to cut hard sheet rubber up to 3/16 in. thick. The method is as follows: Mark on the rubber with a scriber or other sharp instrument an outline of the piece to be cut. Then plunge the sheet into hot water; take it out and cut on the outline with a pair of scissors. The rubber will become soft like leather and cut easily. As it becomes cooler, it will cut harder. If any more cutting is to be done, plunge it into hot water again and continue until the cutting is done. Then put a plate of glass on a newspaper on a table, dip the rubber in the hot water again, place on the glass; then put another sheet of glass over the rubber with a weight on it. When it is cooling the piece will straighten out.—W. S. STANDIFORD.

Finding the Combined Value in Parallel Resistances

WHERE more than two resistances are connected in parallel it usually results in rather complicated calculations in order to determine the combined resistance value. It has been found that an easy way to determine the equivalent of resistances in parallel is by the use of a simple diagram, as shown.

As an illustration, the four resistance values, 225, 450, 900 and 1800 ohms were taken. The procedure is as follows: Decide on some convenient scale to be used. In this instance, each 1/10 in. equals 50 ohms. Lay off a perpendicular line *X-Y* to represent any one of the resistances, the one of the highest value, which in this case is 1800 ohms, probably being the most convenient. Then construct the horizontal line *Y-Z* of any convenient length and erect the perpendicular *A-Z* equal in height to the next highest resistance. On this line lay off the remaining resistances according to the scale selected.

For convenience we will start with the two highest values, although the same results would be accomplished by using the 1800-ohm resistance and any one of the other three shown on line *A-Z*. Draw



A convenient scale for finding the combined value of resistances in parallel

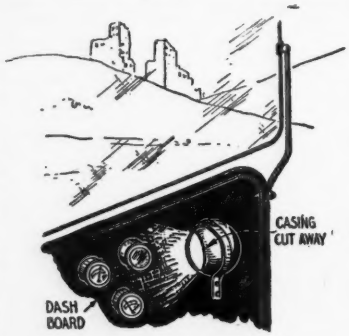
lines *X-Z* and *A-Y*. At their point of intersection, *B*, erect the perpendicular *B-C* whose value represents the equivalent of the 900 and 1800-ohm resistances in parallel. Combine this equivalent with the 450-ohm resistance by drawing line *H-C*. At the point of intersection *D* of this line with the line *B-Z*, which happens to fall on the line *X-Z*, erect the perpen-

dicular *D-C* whose value represents the equivalent of the three resistances in parallel. This equivalent combined in a similar manner with the remaining resistances of 225 ohms gives us the line *F-G* whose value according to the above scale is 120 ohms and represents the combined resistances of the four resistances in parallel. With the four resistances selected this result can be easily verified by the usual method of calculation.

This process may be carried out for any number of resistances. It is evident that the larger the scale selected the more accurate will be the result. The writer has personally found the foregoing method very convenient and more satisfactory than the usual methods, especially where tables of logarithms or reciprocals are not easily available.—F. H. TILLOTSON.

Lighting the Dash-Board of an Automobile from the Side Light

MANY cars are equipped with the so-called flush side light, the lens being flush with the outside, and the back of the lamp extending in on the dash. By simply cutting away a section of the lamp casing, as shown, part of the light will follow the dash, thereby illuminating it sufficiently for all needs.—THOS. W. BENSON.

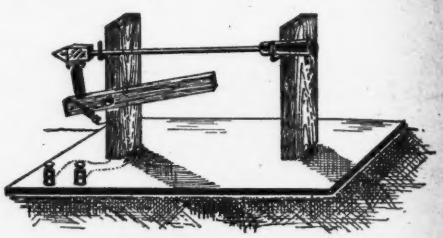


A cut-out on the flush side light to illuminate the dash

Heating a Soldering Iron with an Electric Arc

EXPERIMENTERS often find themselves with some soldering to do, but with no means of heating the soldering iron. Using the iron as one electrode of an arc I found to be a good makeshift.

This suggested the construction of the arc and brackets described herewith. As it is to be used only a short while at a time, and the amperage is small, wood may be used in its construction but it is best to cover the wood with asbestos. Two standards are fastened upright upon the base as shown and near the top of each is placed a screw hook (a nail bent up will do) upon



The soldering iron makes one terminal for the electric arc which heats it

which the iron is to rest. A lever having a hole bored at one end, in which is inserted an ordinary ½-in. arc light carbon is pivoted at its center on a bolt which runs through the middle of the upright. The nut is tightened just enough to hold this lever in whatever position it is placed. As the carbon burns away, adjustment is made with this lever. One binding-post is connected with the hook which supports the iron and the other is connected by a flexible cord with the set screw which holds the carbon in the lever.

This is connected with the line by a resistance in series. A water rheostat which is easily constructed and regulated may be used, or a wire rheostat may be constructed. For a medium-size iron I found 3 amperes was about right. Lowering the resistance will increase the current and consequently the heat of the iron. If direct current is used it is best to connect the positive wire with the carbon, as this will avoid the possibility of pitting the iron.—KENNETH M. BARD.

Sheet Asbestos to Make a Packing for Steam Chests

OWING to the heat imparted to the cylinders and steam chests of steam engines, rubber packing does not give as good service and last as long as it should. After some experimenting, the writer has found that a sheet of asbestos 1/16 in. thick makes a good packing for a steam chest. This material is very cheap, and if put on the engine wet, will stand a pressure of 150 lb. As an experiment, a joint made with the asbestos sheeting was taken apart and put together five times and still held its shape. Experience shows that it makes just as tight a joint as the best rubber packing.—W. S. STANDIFORD.

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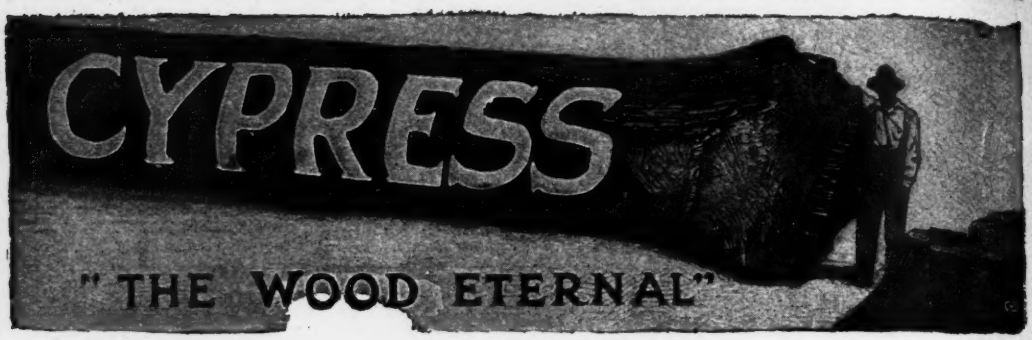

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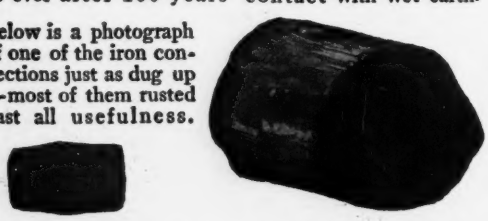

HERE IS CYPRESS *VS.* WEATHER. A photograph of a CYPRESS SHINGLE from the Austen Homestead, Staten Island, N.Y. built in 1710, and at last accounts still occupied by descendants of its original builders, with the original CYPRESS roof practically intact.

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Contents for December, 1917

AERONAUTICS

Fishing in the Air ... 803
A Biplane Which Crashed Through a Roof ... 838
Sixteen Airplanes Against One Destroyer ... 850
The Sun, an Enemy to Airplanes ... 857
Testing Airplane Engines at Factory ... 861
Dummy Airplane Targets ... 866
Commuting by Airplane ... 879
Our Aviation Problems ... 894
Aviators Now Can Carry Their Telephones Under Their Hats ... 907
Testing Airplanes in a Man-Made Storm ... 910

AGRICULTURAL SCIENCE

Hatching Chickens in Glass Globe by Electricity ... 806
The War Gardens of Railroad Employees and Station Agents ... 893
His Majesty, the Turkey ... 902
Cattle-Guard Made of Cactus ... 905
Raising Terrapins on the Farm ... 906
Consider the Rat ... 916

ASTRONOMY

A Parsec—The Greatest Unit of Measurement ... 807
Chained to Our Earth! ... 835

ARCHITECTURE

A Folding Staircase for the Fire Escape ... 839
House Numbers in Concrete ... 875
A Miniature Hotel with Two Thousand Rooms ... 878
A Chimney with Windows ... 892

CHEMISTRY

Making Money Out of a Nuisance. The Industrial Rise of Acetylene Ash ... 848
Oleomargarine Glorified ... 877
Sausage Made from Cottonseed ... 909

CIVIL ENGINEERING

Two Billion Paving Bricks a Year ... 855
Measuring the Flow of Rivers ... 867

ELECTRICITY

A New Way of Oiling Machinery by Electricity ... 825
Illuminated Muffs ... 881
Combining an Electric-Elevator with the Shoe-Shining Chair ... 888
Applying the Principle of the Phonograph to the Telegraph Sounder ... 889
Reducing Packing Costs in Handling Telephone Sets 908
A Telephone Conversation May Be Almost "Private" Nowadays ... 913
Telephone Conversation Made Easy by a New Device ... 919
Charging Storage Batteries with Direct Current ... 947
Simple Method of Making Storage Cells ... 947
Auto-Transformer in Headlight Circuit on a Magneto ... 952
Making a Good Outdoor Ground to a Pipe ... 952
Finding the Combined Value in Parallel Resistances 959
Heating a Soldering Iron with an Electric Arc ... 960

HOUSEKEEPING MADE EASY

Keeping the Shampooing Soap Suds Out of Your Eyes ... 804
Storing Needles and Thread in the Handles of Scissors ... 828
Solving Kitchen Problems Electrically ... 830
Abolishing the Garbage Can ... 833
Rocking the Baby Fore and Aft ... 842
New Shoe-Polishing Kit ... 857
Improved Office Appliances ... 870
Electric Fish-Scaler ... 873
Baby's Wheeled Dressing Table ... 877
Housekeeping Made Easy ... 890-91
A Pelican in Your Wardrobe to Hold Your Coat ... 904
Want to Go to the Attic? Just Pull Down the Stairs ... 912

MECHANICAL ENGINEERING

A New Siphon That Starts Itself Without Suction or Pumping ... 832
Turning Valves on Their Seats Automatically ... 859
Furnace Burns Soft Coal and Cleans Its Own Radiator ... 867
Largest Direct-Current Power Plant ... 868
Improved Mechanical Appliances ... 871
Running the Oven by the Hot-Air Furnace ... 879
Making Flour from Pigskin ... 884
Barking Wood by Machinery ... 885
A Dipper Dredge That Served as a Drydock ... 893
Two Locomotives to the Aid of a Shivering Manufacturing Plant ... 899
Doing the Work of Three Hands with Two, on a Soldering Job ... 900
Which Way Will the Tree Fall? ... 901
New Looms for Old—A Wartime Necessity ... 904
A Collapsible Concrete Form Which Works on the Principle of an Umbrella ... 905
The Smallest Bandsaw ... 907
Another Biggest Thing in the World—This Time a Riveting Machine ... 913
Hot Water in an Instant ... 920

MEDICINE, SURGERY AND HYGIENE

Artificial Lungs for New Born Babies ... 807
It Bathes, Massages, and Dries Us ... 832
The Old Indian Priests Had No Easy Time of It ... 837
Toe Spring for Enlarged Joints and Bunions ... 838
A Disappearing Crutch ... 854
Curing Wounds with Sugar ... 867
Fracture Setting Machine ... 875
Employing Destructive Gases in the Warfare Against the Sleeping Sickness ... 888
Using Brine Baths as a Cure for Shell Shock ... 899
Examining Recruits for Tuberculosis ... 909
Treating the Wounds of the War by Electricity ... 918

MILITARY AND NAVAL SCIENCE

How a Fighting Dummy Teaches Men to Use the Bayonet ... 824
Steel Castings for Modern Dreadnoughts ... 827
Reaching the Soldiers, Wounded Far Up in the Mountains ... 839
The Unsinkable Submarine ... 840
The Possibilities of a 60-Inch Gun ... 844
Testing Shells for Hardness ... 847
The French "Horizon Blue" Is the Best Color for Uniforms ... 848
What Defective Ammunition Means ... 849
New Motor Truck Kitchen ... 851
Blinding the Enemy with Searchlights ... 859
A Bomb in a Piano ... 865
Dummy Airplane Targets ... 866
A German Military Obstacle ... 869
The Latest Sea Camouflage ... 876
Protecting Battleships with Compressed Air ... 886
German Trenches as Comfortable as Houses ... 889
England's Great Under-Sea Walls of Bombs ... 915

MOTOR VEHICLES AND THEIR ACCESSORIES

A New Way of Cushioning the Front Spring Action of an Automobile ... 828
Three-Purpose Electric Drill ... 828
The Automobile Driver Must Know What to Do in Case of Accident ... 831
Bell Gives Warning When Automobile Backs Up ... 834
A Powerful Motor Sprinkler ... 849
New Motor Truck Kitchen ... 851
Automobile Accessories ... 852-53
Mirrors to Avoid Auto Accidents ... 855
Burning Distillate in Your Auto Engine ... 864
Keeping Auto Engine at Right Temperature ... 866
Turning the Headlights Electromagnetically ... 919
Forty-Five Miles an Hour on This Motorcycle Sleigh 920
An Automobile Steering Wheel for a Bob-Sled ... 928

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CONTENTS FOR DECEMBER—Continued

NATURAL SCIENCE — Page

A Lizard That Squirts Blood from Its Eyes 805
Palm Springs 805
Snow Honeycombs and "Penitents" 806
How Did One Egg Get Inside of the Other? 826
The Cut Branch Did Not Die 836
Exploded Beliefs about the Arctic 839
You Can Hold a Dozen of These Coconuts in One Hand 848
The Eccentricities of the Sleeping Horse 851
Can a Frozen Fish Be Restored 873
Mysterious Sound That Baffles Science 881
Eat Your Dates with an Easy Mind 918

PICTURE PAGES

Making Serums for Uncle Sam's Army 808-09
X-Ray Photographs 810-11
Women Working on French Dirigible 812-13
Performing Dogs 814
The Allies' Big Repair Tents 815
Comfort Kits for Our Soldiers 816-17
Avoiding a Broken Head in Boxing 818-19
Fresh Air for New York's Anemic Children 820-21
Making Rifles and Bullets for Our Soldier Boys 822-23

PHOTOGRAPHY AND MOTION PICTURES

A Moving-Picture Show, the Martian Might See 856
A Motion-Picture Camera on One Leg 878
How the Lion and the Lamb Lie Down Together in the Motion Pictures 884
Hang That Book from Your Shoulders 892
Incandescent Lamps May Now Be Used to Project Motion Pictures 893

PRACTICAL WORKERS' DEPARTMENT

Chemical Flasks Made from Electric Light Bulbs 921
A Concrete Mixer Made Out of an Old Mower 921
Comic Photograph Made with Film Negatives 922
Protection Curtain for a Mechanic's Work Bench 922
Testing the Strength of Norway Iron 922
Coating for Window Glass to Keep Off the Frost 923
Instruction Marker for Photographic Plate 923
Drill Holder for the Tailstock of a Lathe 923
Some Useful Hints for the Owner of a Phonograph 923
The Balanced Aquarium for the Proper Care of Fish 924
V-Block with Clamps for Small Drill Press 924
Making a Sprinkler Hose Nozzle for the Boiler Room 925
Making a Gage for an Oil Storage Tank 926
Finishing a Book Trough in Natural Wood 926
An Individual Strap-Hanger for a Crowded Car 927
A Garage Air-Compressor Made from Automobile Engine 927
An Emergency Repair on a Leaking Water Pipe 927
Door Catch Made of a Spring Shoe Tree 928
Reshaping Artists' Paint Tubes for Refilling 928
Tearing a Pack of Cards in Half with Ease 928
Construction of a Bob-Sled 929
Boring Mill Tool-Holder for Saving Expensive Steel 932
An Improvement on an old Card Trick 932
Newspaper as a Substitute for Chalk Talk Board 932
Treadle for an Automobile Foot Accelerator 932
Coal Is Dear. Learn How to Burn It 933
Hand Bob-Sleds Made of Barrel Staves 934
Making Butt Mortises with an Ordinary Rabbet Plane 934
Making a Talking Machine Stylus from a Toothpick 934
Making a Whistling Weather Vane for the Barn 934
Windng a Coil Spring Evenly 934
Cutting Rafters for Gothic Roof Barn Construction 935
Fruit Jar Rubber Ring to Repair Bicycle Tire Puncture 935
The Proper Care of a Soldier's Wardrobe 935
Improving the Qualities of Cheap Lead Pencils 936
A Barrel Stave Iceboat 937
A Homemade Sight Feed Oil Indicator for an Automobile 938
A Simple Method of Fastening Umbrella Handles 938
Simple Designs for Sheet Metal Working 939
Garden Hose Used as a Form for Cement Pipe 941
Eliminating Noise from Shift Levers 941
Repairing a Scratch on an Automobile 941
How to Straighten a Warped Drawing Board 942
Making a High Gloss Finish on a Matt Surface Picture 942
Protecting Drawings on Drawing Board 942
Setting a Lathe Quickly for Taper Turning 942
Teeth of a Hack-Saw Blade Used for Spacing on Section Liner 946
How to Make a Secure Joint in Copper Tubing 948
Things to Know About Lubricants for Machinery 948
Constructing a Thermostat to Regulate Furnace 953
A Coating to Make a Battery-Box Acid Proof 954
Heating Sheet Hard Rubber to Cut Round Disks 959
Lighting the Dash-Board of an Auto from the Side Light 960
Sheet Asbestos to Make a Packing for Steam Chests 960

RADIO COMMUNICATION

The Marconi Company Sues the Government 913
Detecting Defective Insulators 914
The Human Morse Code 950
An Inexpensive Multi-Point Loading Coil 953
Water Glass Gage for a Lead-In Insulator 954
Wireless Work in Wartime 955
An Easily Constructed High Tension Insulator 959

RAILWAYS

Keeping the Trains from Being Blown Off the Tracks 824
A One-Man Rail Grinder 825
A Labor-Saving Dump Car 884

SHIPS AND SHIP BUILDING

Raising Sunken Ships with Collapsible Air Bags 829
Boat Carries Engine in Its Fin 872

SPORTS AND PASTIMES

Making Comfortable Quarters for the Pet Snake 829
Eskimos of Alaska Held a Reindeer Fair 837
The Pull-Motor 842
Watch-Case Revolver 843
Mechanical Toys 862-63
A Christmas Tree Stand 874
A Jungle in a School-Yard 880
The Home-Made Ice Sleds of the Chinese Boys 881
A Toy Gun for the Pacifists 883
Novel Color Mixer for Teaching Color Effects 888
A Billiard Table That Folds Up When Not in Use 909
A Mouse Spins Cotton Thread 912
Winning an Athlete's Laurels 943

MISCELLANY

A Device for Keeping Bananas Clean 804
The War Price on Monkeys 804
A Badge Which Tells the Story of Your Life 807
The Largest Ball of Twine 824
The Most Expensive Coat in All the World 834
How the "Ship of the Desert" Is Anchored When the Caravan Rests 831
Is This the Secret of the Earth's Magnetism 843
Rice for Face Powder 854
A New Method of Learning to Play the Violin 860
Protecting Your Shoes from Mud 861
A Palace of Corn 874
Wealth in Scrap Piles 883
Wearing Spikes on Your Feet to Prevent Slipping on Ice 889
The "Complex Dinner" Container for Long Trips 900
Pull Out a Cigarette and a Lighted Match with One Motion 901
We Boycott the Chinese but Not His Hair 904
To Open a Stubborn Knife-Blade, Throw It from You 907
Arrowhead Lamp Posts Mark the Arrowhead Trail 908
Filtering Out the Harsh Tones from a Phonograph 911
We Use Eighteen Times as Much Light as Did Our Great-Grandfathers 914
Matches? Take One at a Time, Please 914
Sharpening Your Pencil Without Soiling Your Fingers 918

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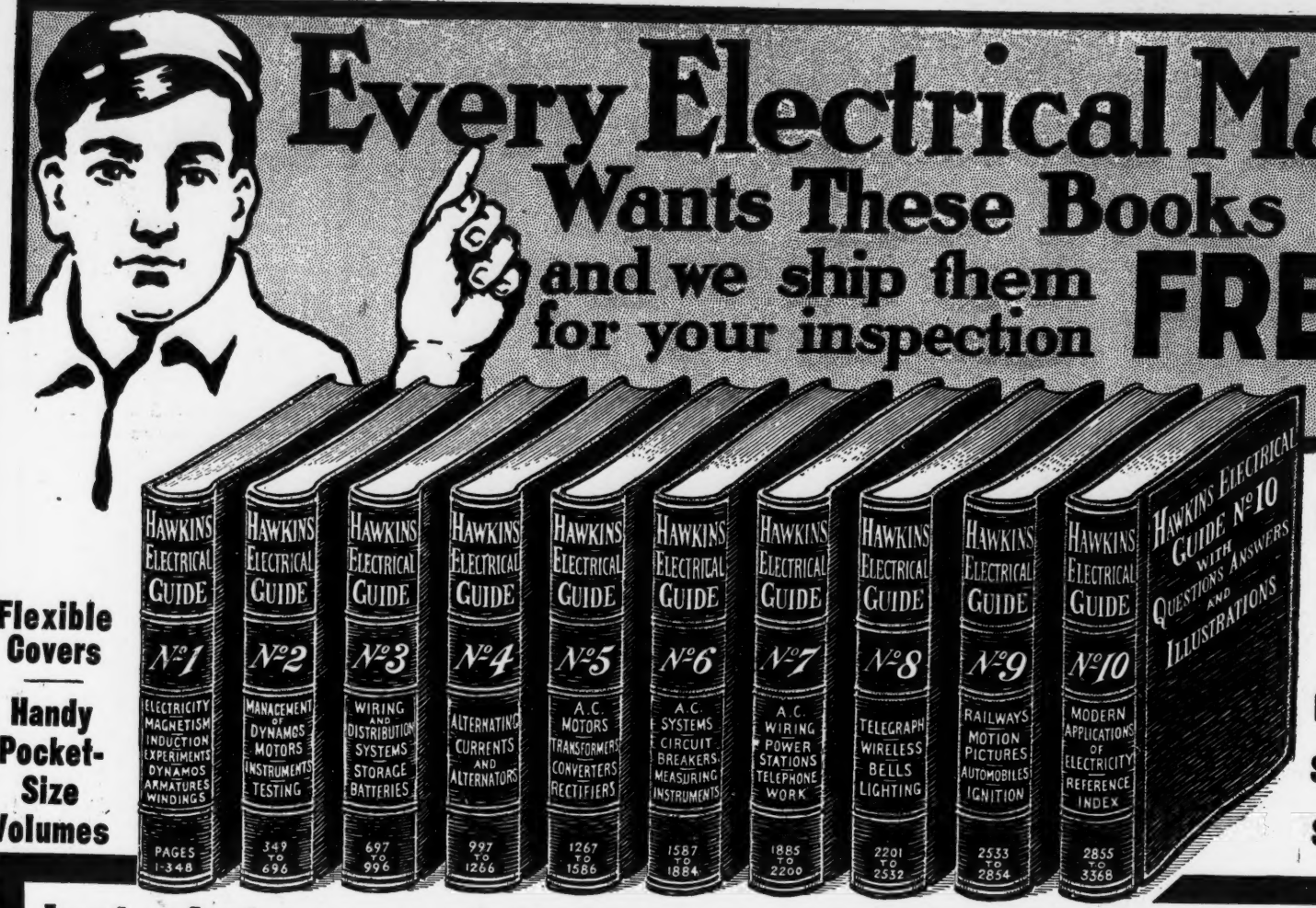
HAWKINS ELECTRICAL GUIDE Nº1 ELECTRICITY MAGNETISM INDUCTION EXPERIMENTS DYNAMOS ARMATURES WINDINGS PAGES 1-348
HAWKINS ELECTRICAL GUIDE Nº2 MANAGEMENT OF DYNAMOS MOTORS INSTRUMENTS TESTING 349 TO 696
HAWKINS ELECTRICAL GUIDE Nº3 WIRING AND DISTRIBUTION SYSTEMS STORAGE BATTERIES 697 TO 996
HAWKINS ELECTRICAL GUIDE Nº4 ALTERNATING CURRENTS AND ALTERNATORS 997 TO 1266
HAWKINS ELECTRICAL GUIDE Nº5 A.C. MOTORS TRANSFORMERS CONVERTERS RECTIFIERS 1267 TO 1586
HAWKINS ELECTRICAL GUIDE Nº6 A.C. SYSTEMS CIRCUIT BREAKERS MEASURING INSTRUMENTS 1587 TO 1884
HAWKINS ELECTRICAL GUIDE Nº7 A.C. WIRING POWER STATIONS TELEPHONE WORK 1885 TO 2200
HAWKINS ELECTRICAL GUIDE Nº8 TELEGRAPH WIRELESS BELLS LIGHTING 2201 TO 2532
HAWKINS ELECTRICAL GUIDE Nº9 RAILWAYS MOTION PICTURES AUTOMOBILES IGNITION 2533 TO 2854
HAWKINS ELECTRICAL GUIDE Nº10 MODERN APPLICATIONS OF ELECTRICITY REFERENCE INDEX 2855 TO 3368
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By R. H. SINCLAIR

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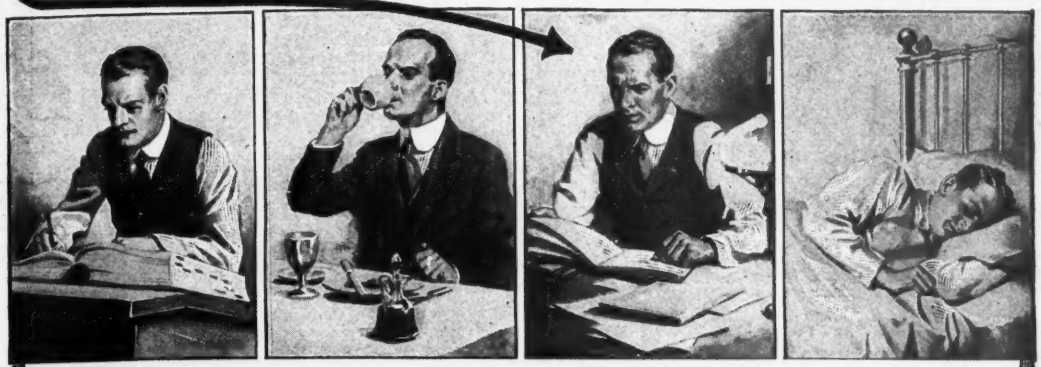

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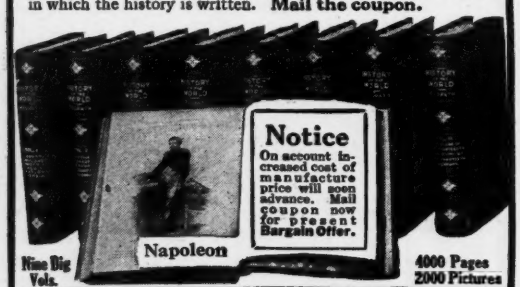
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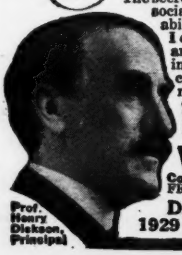

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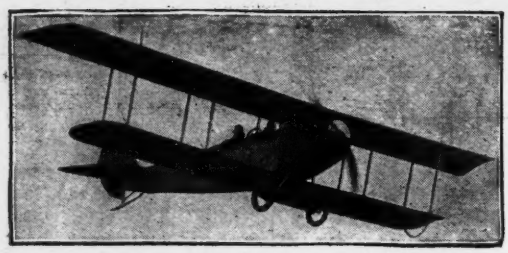

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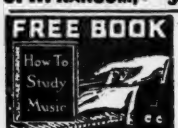

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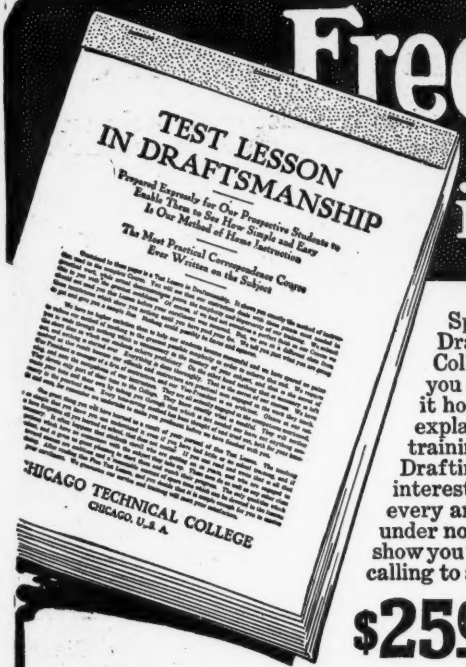
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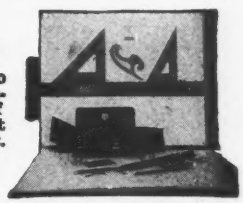

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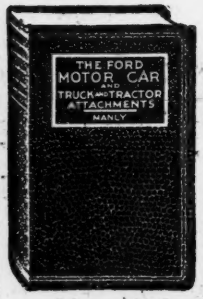

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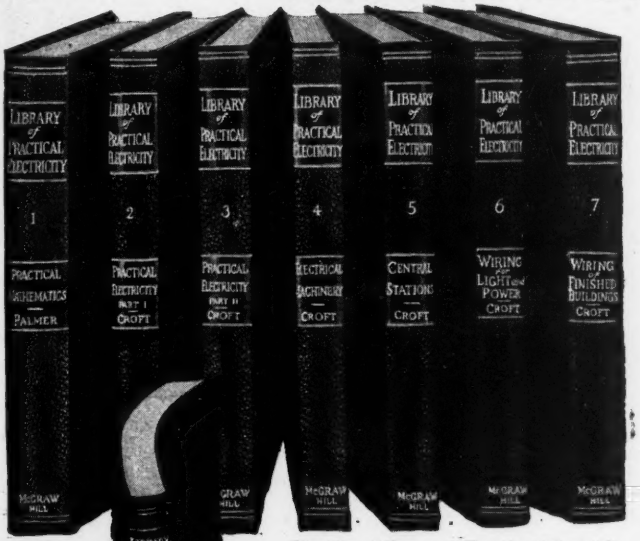

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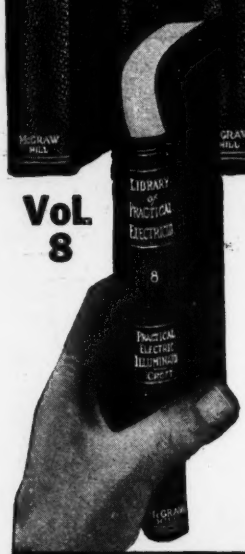

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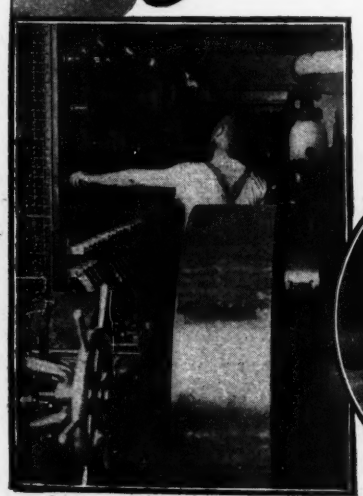

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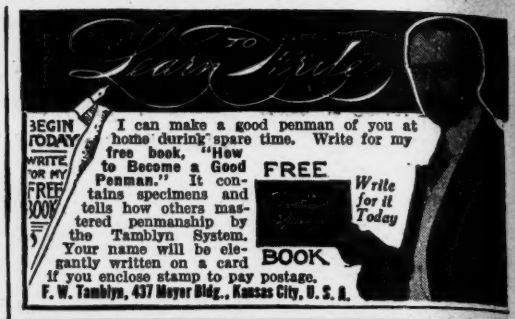

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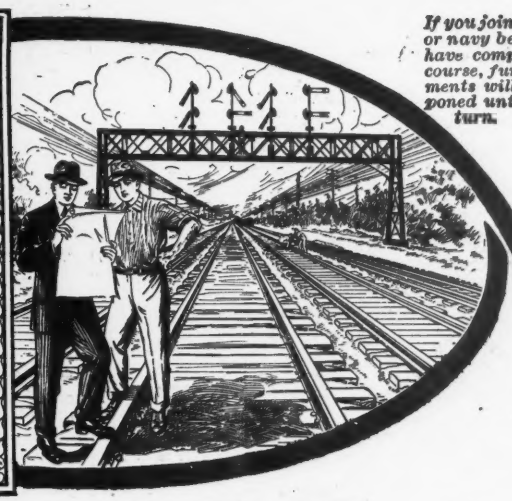

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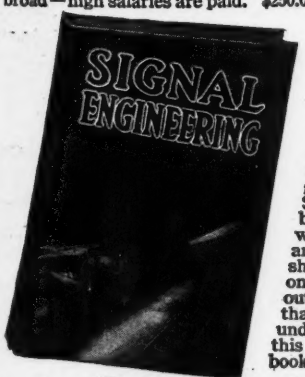

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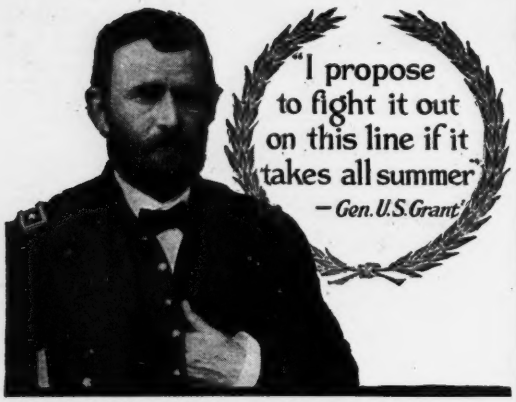

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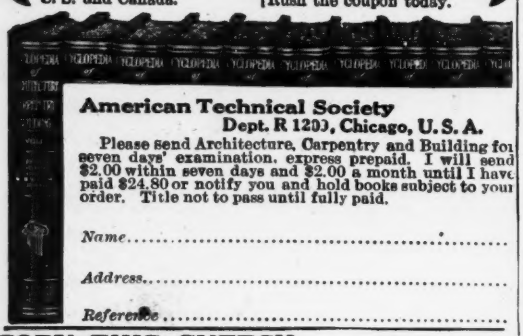

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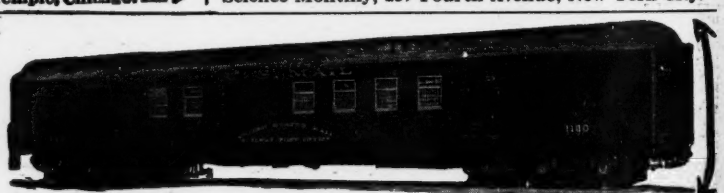

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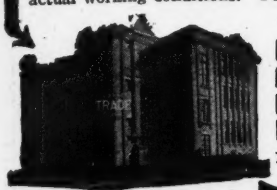

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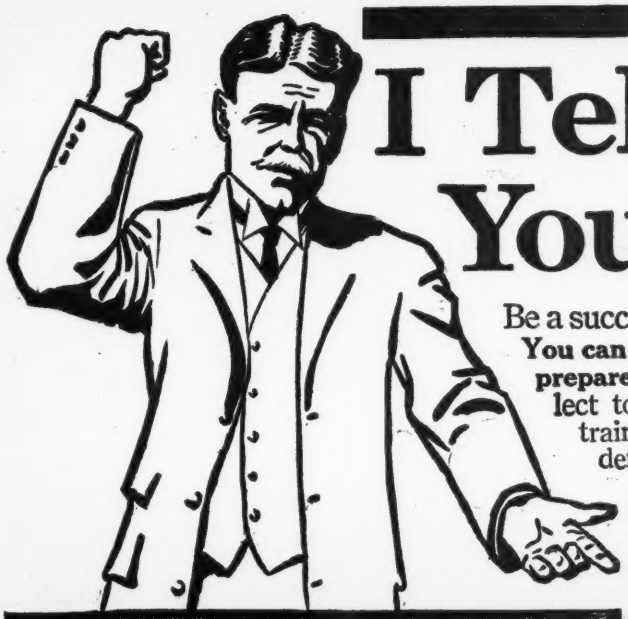

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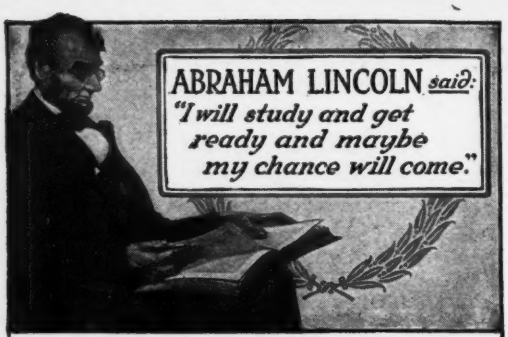

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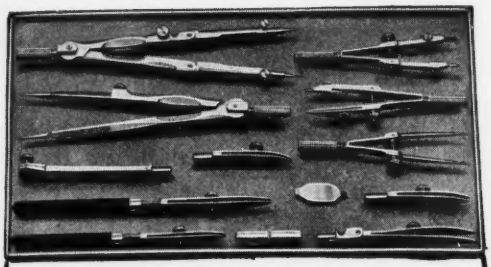

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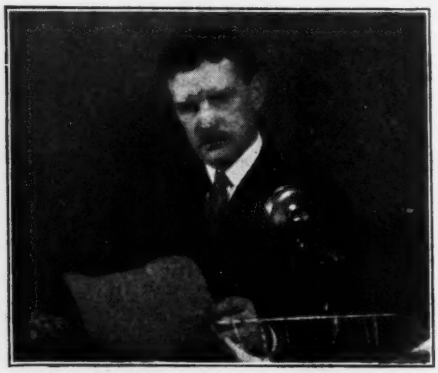

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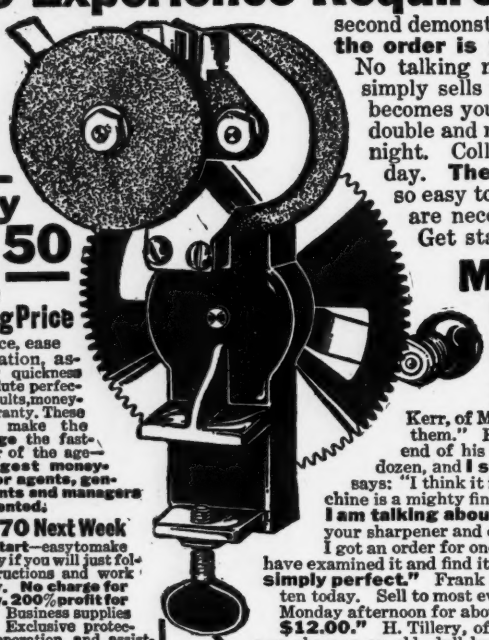
This little machine is a mechanical masterpiece. A child can use it. Just put knife in slot—turn crank—**grinds automatically**—draws blade to keen, sharp, perfect, lasting edge **at absolutely correct bevel for daily use.** Nothing to adjust—nothing to change, nothing to get out of order—**absolutely guaranteed**—will last for years. Once they see it and use it, women will not do without it for several times its cost. One agent wrote: "It was easier for me to learn to sell the **Quickedge** than it was to learn to tear open my pay-envelope in my former dollar-a-day job." Get out of the dollar-a-day class. Get this position, where profits start the first day.

No Experience Required Just take one of the machines to any house and show it—give a ten-second demonstration upon the dullest knife in the house; **the order is yours right on the spot; instantly.** No talking necessary. No argument. The machine simply sells itself, **and stays sold.** Every customer becomes your friend. They tell others, your profits double and multiply. Leave one hundred on trial over night. Collect the cash for every one of them next day. **The machine will do its own talking;** it is so easy to operate, no explanations or instructions are necessary. Secure your county now; **free.** Get started right now and



Only $1.50 Selling Price

Low price, ease of operation, astonishing quickness and absolute perfection of results, money-back guaranty. These things make the **Quickedge** the fastest seller of the age—**the biggest money-maker for agents, general agents and managers ever invented.**

Make $70 Next Week

Easy to start—easy to make big money if you will just follow instructions and work faithfully. **No charge for territory. 200% profit for agents.** Business supplies capital. Exclusive protection, co-operation and assistance. Failure impossible. Nothing to risk. Success assured.

Easy to demonstrate—and every woman is anxious to see it work—then she would not do without it. No talking necessary. Just show the machine and take the order—**one dollar profit on every call you make.**

Send for application blank and complete information today—**free.** Investigate. **Get the proof.** Don't delay. Write a postal card or letter right now. **Territory is being assigned very fast.** Get your county now—**free.** Write today.

The Quickedge Knife and Shear Sharpener

Grinds any Kitchen Knife or Shears in 10 Seconds

Absolutely Guaranteed

Make as Much Money Next Week as These Men are Making Now

J. C. Lewis, of Kansas, says: **"I have sold one hundred Sharpeners in four days."** Hobart Kerr, of Md., writes: "The women can hardly wait till they get them." Herbert Cain, of Ky., sold nine after supper. At the end of his first day, J. W. Gordon, of Pa., writes: "I sold two dozen, and **I sold to every one I saw."** Wm. G. Hall, of N. J., says: "I think it is great. I sold six in about one-half hour. The machine is a mighty fine proposition. **I am a mechanic and I know what I am talking about."** Peter Courtland, of Mich., writes: "I received your sharpener and opened it in a barber shop. I ground his shears and I got an order for one right on the spot." H. A. Henkel, of Va., says: "I have examined it and find it a wonderful little machine. **The workmanship is simply perfect."** Frank King, Colo., says: "Sample received Saturday. Sold ten today. Sell to most every house." Forest Webb, of Pa., says: "Went out Monday afternoon for about three hours and received one dozen orders. **Profit $12.00."** H. Tillery, of Tenn., wrote: "I took three orders first hour. When you sharpen an old, dull knife, dull as a hoe, in less than a minute, **they sit up and look."** Ray Carter, of Mass., writes: "I went out two days and have orders for thirty sharpeners." **Profit $30.00 for first two days.** John Durr, of Wis., also says: **"I have sold thirty in two days."**

You can make this money. **Send now.** Territory free.

GET BUSY. WRITE TODAY.

The Quickedge Sharpener Company
No. 637 Sharpener Building
215 N. Desplaines St., Chicago, Ill.

Are You Equipped To Win?

HOW MANY unfamiliar names, new words, and puzzling war terms in this morning's paper meant nothing but a blank to you?

If you are asked the location of *Trieste*, the meaning of *futurism*, *air-sick*, *Diesel engine*, etc., are you able to give an accurate answer?

How many business letters today showed you examples of words wrongly used, carelessly divided or incorrectly spelled? *Business success* is based on accuracy.

What is a werewolf? What is tufa? What is a Musca? Where is Flanders? How is Przemysl pronounced? What is a sun spot? What is the source of cork? What is felt? What is a gasket? What is hardpan? Where is Saloniki? Is a peanut a nut? What is a satellite? What is a continuous voyage? What are the halogens? Good night means what? How high is Pikes Peak?

WEBSTER'S NEW INTERNATIONAL DICTIONARY

is an all-knowing teacher, a universal question answerer, made by specialists to meet your needs.

Hundreds of thousands of successful business men, engineers, bankers, judges, architects, physicians, teachers, librarians, and clergymen use this "*One Supreme Authority.*"

SALIENT FEATURES:

400,000 Vocabulary Terms.
30,000 Geographical Subjects.
12,000 Biographical Entries.
Thousands of other References.
6,000 Illustrations. 2,700 Pages.

The only dictionary with the new divided page, characterized "A Stroke of Genius." Type matter is equivalent to that of a 15-volume encyclopedia.

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Write for specimen pages of Regular and India-Paper Editions.
FREE—a set of Pocket Maps if you mention this magazine.

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Gentlemen: Please send me specimens of Regular and India Papers, Illustrations, etc. Include FREE Pocket Maps per Pop. S. Mo.

Name.....

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The New York Electrical School

Men of All Ages

Whether Sixty or Sixteen, you are assured absolute success in the future if you attend the only school devoted to teaching every angle of Electrical Industry by a method of "actual practice." All ages enter this school on the same level, are shown "how" and "why," and make rapid progress under the watchful eye of a staff of highly trained and experienced men. No preparation needed to take this course and you can start any day of any week throughout the whole year.

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business methods of Electrical Contracting; together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity.

Write for illustrated booklet and "be shown" what the N. Y. Electrical School can do for YOU.

40 WEST 17TH STREET, NEW YORK

33,000 sq.ft. of Additional Floor Space

Come to Detroit
The Automobile Center and
LEARN THE AUTOMOBILE BUSINESS

DETROIT trained men get preference and get jobs quickly. No other city can give what Detroit offers. Think what it means to learn in the Michigan State Auto School. Factories endorse our school, glad to employ our graduates or offer them territory in which to sell cars and start garages. Unlimited opportunities. 71% of Automobiles are made in Detroit. You're right in the Heart of the Auto Industry. Men are needed everywhere as testers, repairmen, chauffeurs, garage men, and salesmen. Hundreds of our graduates start in business for themselves.

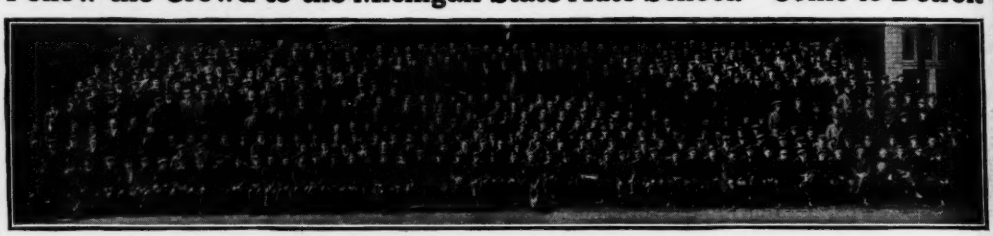
Earn $75 to $300 a Month

We teach you to handle any auto proposition. You graduate in from ten to twelve weeks. Our equipment is new, up-to-the-minute, and complete. No old, obsolete motors, chasses or electrical equipment used. Students actually build cars from start to finish, getting factory training in assembling, block-testing, road-testing, everything. Special complete course in Oxy-Acetylene brazing, welding and cutting, separate from regular course. Learn to time motors, rebore cylinders, adjust carburetors, magnetos, valves and bearings quickly and accurately. Six-cylinder Lozier, Chalmers "6," Detroiter "6," Overland, and 8-cylinder King are used for road instruction. We have the following completely equipped chasses:

Chalmers "6-30" 1917 chassis
Detroiter "6-45" 1917 chassis
Buick Light "6" 1917 chassis
Willys-Knight 1917 chassis
Studebaker "6" 1917 chassis
Hudson Super-Six 1917 chassis
Cole "8" 1917 chassis
King "8" 1917 chassis
Metz "4" 1917 chassis
Detroit Electric 1917 chassis
G. M. C. 2 Ton Truck
Saxon "6" 1917 chassis
Maxwell 1917 chassis
Oldsmobile "8" 1917 chassis
Winton "6" chassis
Packard Twin "6" 1917 chassis
Chalmers "4" 1913 chassis

All completely equipped for students to work on. We have more than 20 motors in our block test department—2 cyl., 4 cyl., 6 cyl., 8 cyl., and 12 cyl. Our electrical department is complete, having every standard starting, lighting, and ignition system, including Delco System as used in Buick, Hudson, and Packard Twin "6."

Follow the Crowd to the Michigan State Auto School. Come to Detroit



THIS IS ONE OF THE FEBRUARY 1917 CLASSES

Detroit Is the Place to Learn—Start Any Time

There are 44 auto factories in Detroit and vicinity and 140 accessories and parts factories. Our students have the privilege of going through any or all of them. We operate Starting, Lighting, Ignition Service Station. This has added thousands of dollars' worth of equipment and makes our electrical department unequaled. Students get actual experience in handling all kinds of electrical auto equipment and taking care of trouble. We have just installed a Sprague Electric Dynamometer for block-testing purposes for students' use. Ours is the only Auto school having this equipment. Auto factories need Dynamometer men constantly. Factories and garages are paying big salaries to men who know how to handle electrical equipment quickly and properly. Detroit is the automobile center. You get practical instruction. School open all the year. Enter classes any time, any day. Three classes daily: morning, afternoon, evening. All Instructors are members of the Society of Automobile Engineers (S.A.E.) There is a great demand for Michigan State Auto School students. Auto factories write and phone for men constantly.

Money-Back Guarantee

We guarantee to qualify you in a short time for a position as chauffeur, repair man, tester, demonstrator, auto electrician, garage man, or automobile dealer, paying from $75 to $300 monthly or refund your money. We have constantly more requests for Detroit trained men at GOOD salaries than we can supply.

SEND THIS COUPON TODAY

MICHIGAN STATE AUTO SCHOOL
592 Auto Bldg., 687-89-91 Woodward Ave.
DETROIT, MICHIGAN, U. S. A.

Gentlemen: Send me absolutely FREE literature on Aeroplane Motor Mechanics Course, "Auto School News" and New Catalog, or better still, you can expect me about.....

Name.....

Street.....

Town..... State.....

Automobile Factories Endorse Our School

The Leading Automobile factories in Detroit, as well as in other cities, endorse our school. They have been watching our school and graduates for years and are satisfied. They are putting their latest model, complete chasses in our school for students to work on. They are employing our graduates in their factories and service stations and assisting them in opening garages and salesrooms. They allow our students to go through their factories. They need trained, competent men and are asking for more of our graduates constantly. The Michigan State Auto School in Detroit, the heart of the Auto Industry, is endorsed by the Leading Auto Factories, is receiving their hearty co-operation. What better endorsement could you ask?

Act Quickly—NOW!

Fill in the coupon; get literature on aeroplane motor mechanics, "Auto School News" and New 128-Page Illustrated Catalog. **All absolutely free.** Or better still, jump on the train, as hundreds have done, and come to the "Heart of the Automobile Industry," and learn right. We have no branches. Write or come direct to this school.

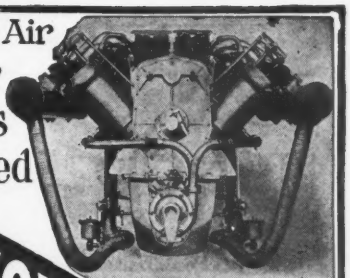
MICHIGAN STATE AUTO SCHOOL

The Old Reliable School A. G. ZELLER, Pres.
592 Auto Building, 687-89-91 Woodward Ave.
DETROIT, MICH., U. S. A.

The War Will Be Won In The Air

PREPARE TO SERVE YOUR COUNTRY

Aeroplane Motor Mechanics Needed



CURTISS 200 Horse Power Aeroplane Motor

The war will be won in the air. A course in Aeroplane Motor Mechanics is now being taught at the Michigan State Auto School. We have secured, by special permission, Curtiss Aeronautical Motors for practice and study purposes. We have also arranged with the Curtiss Aeroplane Company for a complete Aeroplane and a great quantity of the aeroplane material. Students will be given practical instruction on the Aeroplane motor and will secure complete knowledge of the plane in general.

Aeroplane Motor Course Started October 1st

The course is under direct supervision of a Curtiss expert who is an authority on aero-motors and aeroplanes as well as hydros and flying boats. Weeks have been spent in perfecting this course which is entirely separate from our Automobile course. Our plans are complete. A special price is made to those who enroll before November 15, 1917.

Prepare to Serve Your Country!

Become An Aeroplane Motor Mechanic

Aeroplanes will win the war. They are the eyes of the army. They must be in perfect running condition. Thousands of keen, well-trained men are needed by the Government to care for the aeroplanes and aeroplane motors. Men are needed in the aeroplane factories. Trained Aero-motor mechanics will get the preference.

Get Into This New Industry Now

The men who become trained Aeroplane Motor Mechanics now will be big men in the aeroplane business. Only a short time ago the automobile business was starting, the men who got in then are now the Big Men. The Aeroplane business is in its infancy. The war will give it a big start. The men who train now will be the Big Men in the near future. The work is extremely interesting and will grow in interest as the business develops. Aeroplanes and Seaplanes will be used for every purpose. Trained Aero-motor mechanics will always be in big demand.

THE CURTISS AEROPLANE CO.
AEROPLANES, HYDROAEROPLANES FLYING BOATS, AERONAUTICAL MOTORS
BUFFALO, U. S. A.

September 17, 1917.

MR. A. G. ZELLER,
Michigan State Auto School, Detroit, Mich.

Dear Mr. Zeller:

In accordance with our conversation I have asked the Sales Department to send you a collection of motor and aeroplane parts which you can use in connection with your aeroplane mechanics' school. You will find, I think, a sufficient number of parts so that you will have no difficulty in explaining to your students the general principles of construction and operation.

These models, together with the literature which you now have will, I believe, furnish a valuable background upon which your new school work can be based. There is going to be a big demand for good aeroplane mechanics and for that reason we believe that your activity along this line is very timely and commendable.

Very truly yours,
THE CURTISS AEROPLANE CO.
F. L. Faurote (*Signed*) F. L. FAUROTE,
W. F. W. Advertising Manager.

Special Price Up to November 15th

As a special inducement to those who enroll before November 15th, 1917, we will make liberal discount in the price of the Aeroplane Motor Mechanics' Course. The rate will be raised after that date.

Don't hesitate; get into this new industry now. The far-sighted, keen fellows who enter at once will reap the big benefits.

Write Now for literature and use the coupon on opposite page.

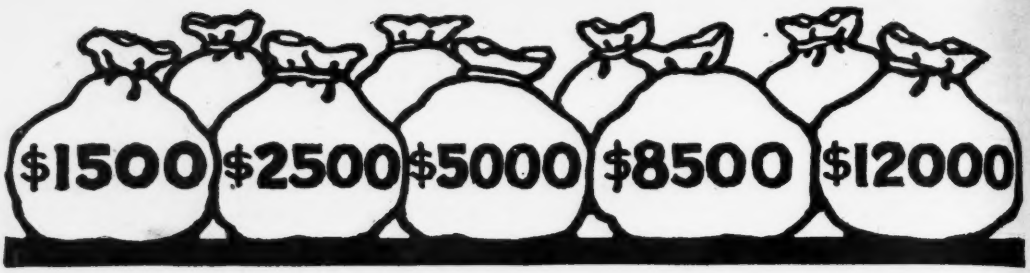
No matter whether you join the colors or stay at home, you can do your bit best as a trained man.

The Old Reliable School

Michigan State Auto School

A. G. ZELLER
President

592 Auto Bldg., 687-89-91 Woodward Ave. DETROIT, MICHIGAN, U. S. A.



Reach Up and Help Yourself!

Train for a Better Job---Attractive Salaries in Many Trades and Professions Await Claimants

Electrical Engineer, $2000—$5000	**Mechanical Engineer, $2000—$5000**	**Architect, $2000—$7000**	**Draftsman and Designer, $1500—$2500**
Steam Engineer, $1500—$2500	**Lawyer, $2000—$5000**	**Sanitary Engineer, $2000—$5000**	**Automobile Engineer, $2000—$5000**
Civil Engineer, $2000—$5000	**Telephone Expert, $2000—$5000**	**Fire Prevention Expert $2000—$5000**	**Bookkeeper and Accountant, $1500—$2500**
Shop Superintendent, $2000—$5000	**Business Manager, $2000—$10,000**	**Contractor and Builder, $2000—$5000**	**Certified Public Accountant, $2000—$10,000**

(Mark with an X the position you prefer)

Opportunity thunders at the door of every man who has ambition and natural ability. Industrial America is undermanned. War activities, on a scale so vast as to stagger the imagination, necessitate the quick training of a great secondary army of technical experts. These men must also help rebuild the world after the war is over. Get in training for one of the Big Jobs by taking an American Home Study Course in any one of 32 trades and professions.

We Have Trained 50,000 Winners!

We offered them their chance—**they grasped it!** We helped them to better positions, larger incomes, broader opportunities, **because they helped themselves.**

You—***today***—have a better chance.

Now the position seeks the man and salaries for high-class men are more liberal than were ever known before.

Mail This Ad for Free Book and Personal Analysis

Send us your name and address on the coupon. Just check the job that you want to hold and mail this advertisement to us. We will tell you how you can get just the training you need, right in your own home. We will tell you how to line up your natural talents with your practical experiences.

Write today for the personal examination blank and bulletin of American home study courses. Do it now—you'll be under no obligations.

American School of Correspondence, Chicago, U.S.A.

Dept. G 1209

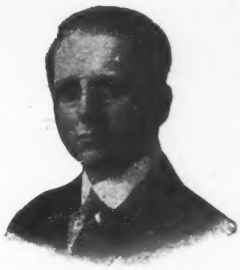
Please tell me how I can qualify for the position marked **X**

Name.....

Address.....

CHARLES E. MURNAN
United Drug Company

C. LOUIS ALLEN
Pyrene Manufacturing Company



C. C. HOLMES
H. C. Capwell Company

Big executive positions won by three young men

Three young men have recently made their mark in the business world. Each is a big executive before his fortieth year.

Charles E. Murnan began his career as a store clerk. At 25 he held a responsible position with the United Drug Company, a corporation capitalized at fifty-two million dollars. Today, in his 36th year, he is not only director of this firm's advertising but vice-president as well.

C. Louis Allen, at 32 became president of the Pyrene Company, a million dollar manufacturing corporation. In three years he has risen from a salesman's job to the highest executive position in the firm.

C. C. Holmes, is superintendent of the H. C. Capwell Company, of Oakland, California—one of the largest mercantile houses of the western United States. His salary has increased 240% in the past two years. One of his plans has reduced his company's operating expenses $30,000 annually.

They know the fundamentals of Business

These men are dealing with entirely different products. But they have one common factor in their careers. All three have ***prepared*** for success by study.

They realized that experience limited to one department of business cannot carry a man far in the modern business world. They wanted to learn the big fundamentals underlying ***all*** departments of business. For this reason they availed themselves of the knowledge contained in the Modern Business Course and Service of the Alexander Hamilton Institute.

What big executives say of the Course

Charles E. Murnan says, "I would recommend it to anybody if he had to borrow the money to take it. It is the most concise and clearly presented form of education ever offered to executives."

"From reading the Alexander Hamilton Course," says C. Louis Allen, "I am convinced that it will help every man who is filling his present job and reaching for another."

Holmes' comment: "There is no doubt in my mind but that every business man and woman of America should read your Course. My only regret is that more of our people have not taken it up."

Based upon the experience of thousands of successful men

The Institute collects, classifies, and transmits thru the Modern Business Course and Service, the best thought and practice in modern business. It gives a knowledge that could otherwise be obtained *only* by years of experience—if at all.

The kind of men enrolled

Presidents of big corporations are often enrolled for the Modern Business Course and Service, along with ambitious young men in their employ.

Among the 60,000 subscribers are such men as A. T. Harden, Vice-President New York Central Lines; E. R. Behrend, President Hammermill Paper Co.; N. A. Hawkins, Manager of Sales, Ford Motor Co.; William C. D'Arcy, President Associated Advertising Clubs of the World—and scores of others equally prominent.

"Forging Ahead in Business"

A careful reading of the interesting book "Forging Ahead in Business," will show you how to prepare for the increasing number of business opportunities that are bound to come during the next few years. Every man and woman with either a business or a career to guide to bigger, surer success should read this book. Simply fill out and send the coupon below.

Alexander Hamilton Institute
367 Astor Place New York City

Send me "Forging Ahead in Business"—FREE

Name .....
Print here

Business Address .....
City *State*

Business Position .....

How Four Pitiful Failures Discovered the Road to Fortune

NOTE: Men are asking—"How can I earn more money—what shall I do to reach the turning point in my life?" These remarkable instances of how four failures found the answer may point the way to you.

By Stanley D. Hopkins

A YOUNG man in the East had an article for which there was a nation-wide demand. For twelve years he "puttered around" with it, barely eking out a living. Three years ago he began to analyze himself. He discovered that his one great fault was his inability to come to a quick, definite decision. Time and again he had tried, in a half-hearted way, to market his goods. This time he steeled himself to fight a winning battle. He began to develop his strength of will so that no imaginary mountain could turn him aside from his purpose.

From $30 to $1,000 a Week

Today this young man is worth $200,000. He is building a $25,000 home—and paying cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing, or traveling whenever the mood strikes him. His income is over a thousand dollars a week and he attributes his amazing success to his super-developed power of will.

A Failure at 60—Then Sudden Success

In a little town in New York lives a man who two years ago was pitied by all who knew him. From the time he was 14 he had worked and slaved—and at 60 was looked upon as a failure. Without work, in debt to his charitable friends, with an invalid son to support, the outlook was pitchy black.

Then, suddenly, things began to happen. He went to the owner of an old vacant factory, secured the place at a ridiculously low rent, with the first three months rent free. He almost *demanded* a loan of $500 with which to begin some experiments. In three weeks he was out for business. In three months his plant was working day and night to fill orders. During 1916 the profits were $20,000. During 1917 the profits, it is estimated, will run close to $40,000. And this genial 62-year-young man is enjoying pleasures and comforts he little dreamed would ever be his.

Ask him what made the remarkable change in his life and he will tell you that it was his life-and-death determination to whip *his own mind*—so that he could do the things he wanted to do without being hampered by a weak, milk-and-water will.

Former Newsboy Heads $1,000,000 Business

From "peddling papers," to the management of a concern doing business of over a million dollars a year, is a far cry indeed. Yet this is the remarkable achievement of a 26-year-old youth from the West. Born of Russian parents, raised in a tenement, with no education save that gained in the ordinary grade school, this young business giant forced his way to the front rank of his profession. For a while after he stopped selling papers he drifted around from job to job. Two years ago he made his present connection. Today he drives around in his own motor car, his income is almost unbelievable when one considers the handicaps he had to overcome, and his prospects for "five-figure" yearly earnings are exceedingly bright. He disclaims all credit for his success—stating that it was only

through systematically developing his personality and will-power that he was able to make his way so rapidly.

A School Teacher's Rise

A teacher in a little town just outside of Chicago was so "down and out" that he couldn't pay a $10 debt which he had contracted months before. Every cent he had scraped together had been lost through an investment in a corporation that failed to make good. Discouraged, sick at heart, he was forced to do something quickly to recoup his losses. He secured a position in a small private school, and in a remarkably short time was the owner of it. As he says, "I am the owner of a business worth many thousands of dollars and owe no man a cent." Talk to him and he will tell you what his newly revived strength of mind has done for him!

Their Guide to Wealth

These are but a few of the hundreds of achievements brought about through systematic will-power development. Regardless of what a man may be—what failures he may have gone through—he can have practically anything he wants out of life if he will but use and develop his God-given power of will. For will-power is the secret of every great achievement. It makes weak men strong. It makes leaders out of followers. It makes doers out of dreamers. It makes dominating personalities out of cringing wrecks of humanity. It makes successes out of failures. It makes dollars jingle where only pennies clinked before.

And the most wonderful thing about a strong will is that it may easily be acquired by anyone. Prof. Frank Channing Haddock—a scientist whose name ranks with James, Bergson, and Royce—after 20 years of research, investigation and study, has prepared a remarkable set of actual exercises, lessons and new methods which have already revolutionized the lives of over 200,000 men and women in all parts of the world. This book, called "Power of Will," is issued by the Pelton Publishing Co., of Meriden, Conn. Mr. Pelton has authorized me to say that any reader who cares to examine the book may do so without sending any money in advance. In other words, if after a week's reading you do not feel that this book is worth $3, the small sum asked, return it and you will owe nothing.

When you receive your copy for examination I suggest that you first read the articles on: The law on great thinking; how to develop analytical power; how to perfectly concentrate on any subject; how to guard against errors in thought; how to drive from the mind unwelcome thoughts: how to develop fearlessness; how to use the mind in sickness; how to acquire a dominating personality.

No Money in Advance

Some few doubters will scoff at the idea of will-power being the fountainhead of wealth, position and everything we are striving for, and some may say that no mere book can teach the development of the will. But the great mass of intelligent men and women will at least investigate for themselves by sending for the book at the publisher's risk. I am sure that any book that has done for thousands what "Power of Will" has done, is well worth investigating.

It is interesting to note that among the 200,000 owners who have read, used and praised "Power of Will" are such prominent men as Supreme Court Justice Parker; Wu Ting Fang, ex-U. S. Chinese Ambassador; Lieut.-Gov. McKelvie, of Nebraska; Assistant Postmaster-General Britt; General Manager Christeson, of Wells-Fargo Express Co.; E. St. Elmo Lewis; Governor Arthur Capper of Kansas, and thousands of others.

As a first step in will training, I would suggest immediate action in this matter before you. It is not even necessary to write a letter. Use the form below, if you prefer, addressing it to the Pelton Publishing Company, 14-W Wilcox Block, Meriden, Conn., and the book will come by return mail. This one act may mean the turning point of your life, as it has meant to me and to so many others.

PELTON PUBLISHING COMPANY,
14-W Wilcox Block, Meriden, Conn.

I will examine a copy of "Power of Will" and I agree to remit $3 or remail the book in five days.

Name.....

Address .....

Cold When Driving?

Not if You Use a

Clark Heater

(No. 7C) A popular heater handsomely covered with Mohair plush in maroon, blue or green, **$4.75.**

Don't lay up your car for the winter. **Enjoy** driving—keep warm as toast—even in coldest weather—with a Clark Heater. The cost is small, operation simple and inexpensive. No flame—no smoke—no odor.

(No. 5B) Light and handy heater. Oval type heater showing drawer with Clark brick, **$2.00.**

Keeps Car Warm Without Running Engine

The Clark Heater is self contained. Entirely independent of the engine. Gives warmth just the same whether car is running or idle. Looks like a foot rest. Handsomely upholstered with carpet. It's made of heavy metal sheet steel; asbestos lined. Uses our celebrated Clark Carbon Brick. One brick gives 12 to 16 hours heat—half a brick gives 6 to 8 hours heat. Clean, simple, easy to use. A wonderful comfort. Prices **$2** to **$10.**

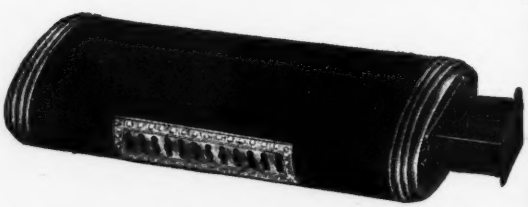
(No. 7D) Strong and durable. **One of the most popular sellers, $2.50.**

Dealers and Garage-men

Clark Heaters are the **best** thing for a **big need.** They make a **live line** for the dull winter season. Write us about our attractive assortments of Clark Heaters and proposition for dealers and garage-men.

Get a Clark Heater At Your Dealer's

If you cannot, send order direct to us, mentioning dealer's name. Write for our **free catalog.**



(No. 8xx) "The Duchess." Our De Luxe Heater for automobiles. Covered with rich velvet plush, **$10.00.**

Chicago Flexible Shaft Co.

Dept. J, 12th St. & Central Ave.

CHICAGO, ILL.

The Fate of the Unprepared

Among the remarkable events of this war no fact stands out more startlingly than the tragic sacrifice of Russia's unequipped soldiers.

The army has been victimized by intrigue and treachery. Guns were sent to the front without ammunition and ammunition without guns. Supplies were provided that when unpacked proved to be rubbish. Left stranded by communications that broke down under slight pressure the brave Russian troops hurled themselves again and again against foes perfectly prepared.

From the very verge of victory they doggedly fell back fighting with stones and clubs and iron bars, resisting heroically but ineffectively.

No thought can be more abhorrent to Americans than that of our boys ruthlessly slaughtered because of lack of equipment or support which it is the first business of us at home to supply.

Our Government, never before so powerful, is working prodigiously in the preparation of armies and means of warfare. Throughout the nation there is a unity of purpose that is piling on the altar of liberty every personal ambition and corporate gain.

Mines, factories, farms, shipyards, the counting houses and shops of every industry are laboring day and night to supply the sinews of war.

The Bell System is co-operating to mobilize production, transportation and communication, and is using its every energy to speed up American defense.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy ***One System*** ***Universal Service***

Men, Snuggle Up to This Bang-up Underwear—It's a Downright Bargain

You can bet your last cent that Hanes will give you more real value for your money than any other buy. No frills, no fol-de-rols—just downright value and a heaping lot of it, too.

Hanes is form-fitting, elastic and comfortable. The fleecy-warm cotton is mighty fine protection from the cold—and it feels mighty good, too. Pre-shrinking keeps it true to size and shape.

Greatest Winter Underwear **HANES** Sold at Popular Prices

ELASTIC KNIT

UNDERWEAR

And just read about these special features over there in the illustration. No more high-priced underwear for the man who sees Hanes. It's just the popular price for everybody and the underwear everyone should wear.

Elastic Shoulders
Guaranteed unbreakable. Bull strong and comfortable. "Gives" with every motion.
Elastic Collarette
Fits snugly, keeps out the cold. Helps make Hanes "form fit."
Improved Cuffs
Strongly and firmly knit; snug fitting. Won't rip where it joins.
Staunch Waistband Double Gusset
Strongly made and thoroughly sewn. Kind of *extra value* like you find all over it.
We Guarantee
Every thread, stitch and button. We further guarantee to return your money or give you another new garment if any seam breaks.

Mothers, Fathers—Get this Big Bargain

A jam-up boy's union suit, chock-full of all the big features on the men's suits. Downy-soft, warm and everlastingly fine, its value can't be duplicated. You sure ought to buy this splendid underwear for your youngsters. See if it doesn't put it all over anything you ever tried at twice the price!

P. H. HANES KNITTING COMPANY
Winston-Salem, N. C.

This Label on Every Garment

HANES

Buy None Without It

Warning to the Trade—Any garment offered as Hanes is a substitute unless it bears the "Hanes" Label.

Pictures from Home

Over there, with thousands of miles of sea and land between them and home, are Our Boys, smiling and fighting—fighting with bullets, against a dogged foe; with smiles, fighting homesickness and dread monotony.

It's a part of the nation's job to-day to keep those boys cheerful, to hold fast the bonds between camp and home, to make light hearts and smiling faces—and these things pictures can help to do—pictures of the home folks and the home doings, pictures of the neighbors, pictures that will enliven their memories of the days before the war—simple Kodak pictures, such as you can make. These can help.

EASTMAN KODAK CO., ROCHESTER, N. Y.

When writing to Advertisers please mention Popular Science Monthly

Chesterfield
CIGARETTES

of Imported and Domestic tobaccos—Blended

The *new* blend—and it can't be copied

The *new blend* of Imported and Domestic tobaccos in this *new* cigarette, Chesterfield, does a *new* and important thing for smokers—

Chesterfields "reach home," they *let you know you are smoking* —they *"Satisfy"!*

Yet, they're Mild!

There *is* more to a cigarette than merely the good taste. Easy to prove it—try Chesterfields. Today. Liggett & Myers Tobacco Co.

SEND HIM THE TIN OF 100. We'll mail the tin for you (100 for 65c) prepaid to any address in the U. S. (training camps, etc.) if your dealer hasn't them. Address Liggett & Myers Tobacco Co., 212 Fifth Ave., New York.

They "Satisfy"— and yet they're Mild!

ACHIEVEMENT

Twenty-five years ago the General Electric Company was founded.

Since then electricity has sent its thrill through the whole structure of life.

Eager to turn wheels, to lift and carry, to banish dark, to gather heat, to hurl voices and thoughts across space, to give the world new tools for its work—electricity has bent to man's will.

Throughout this period the General Electric Company has held the great responsibilities and high ideals of leadership.

It has set free the spirit of research.

It has given tangible form to invention, in apparatus of infinite precision and gigantic power.

And it has gone forth, co-operating with every industry, to command this unseen force and fetch it far to serve all people.

By the achievements which this company has already recorded may best be judged the greater ends its future shall attain, the deeper mysteries it yet shall solve in electrifying more and more of the world's work.

7317

GENERAL ELECTRIC COMPANY

Science Gave Us Radiolite

Radium is a comparatively new scientific discovery. Now the world's greatest watch factories have utilized Radium to make a substance for illuminating Ingersoll hands and figures. This substance has been named Radiolite. The only watches that can be Radiolites are Ingersoll Watches.

Radiolite hands and figures double the usefulness of the Ingersoll Watch—and the Ingersoll has long been the utility watch of the world.

Radiolite glows brightly at night. It makes the hands and figures of Ingersoll Radiolite Watches plainly visible in pitchy darkness. It is self-luminous — unlike phosphorescent paint, which can only absorb light and later throw it off.

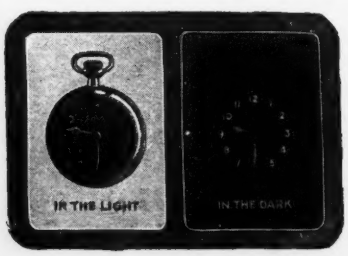
Buy an Ingersoll Radiolite Watch. Own a proven time piece that has been perfected by one of the greatest discoveries in the history of science. Let radium tell you every minute of every hour of every night at a glance.

Look for Ingersoll on the dial—for only Ingersolls are Radiolites.

ROBT. H. INGERSOLL & BRO.

New York Boston Chicago San Francisco Montreal

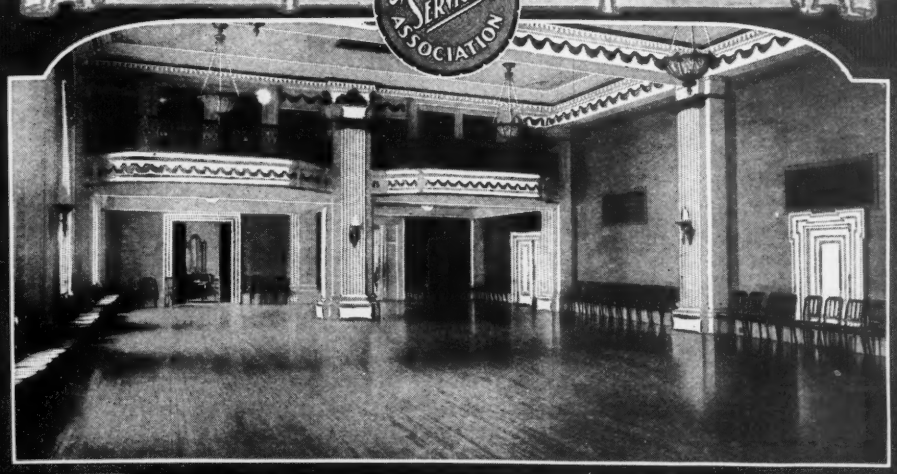
Radiolite—$2.25
In Canada $2.50
The regular Ingersoll with a radium-lighted dial



Ingersoll

Waterbury Radiolite $4.50
In Canada $4.50
A small, handsome jeweled watch

RADIOLITE WATCHES
$2.25 to $4.50
Illustrations three-fifths actual size



Southern Pine floor of the ballroom in the new Hotel Kimball, Springfield, Mass.

The Floor Beautiful

FLOORS are the foundation of a successful interior both as to appearance and color scheme. A good floor is beautiful in itself and supplies the necessary background for the home furnishings. There is no better wood for flooring than—

Southern Pine

"The Wood of Service"

The "close," compact grain of Southern Pine makes a smooth floor and one that is easily finished. The wood, although naturally light in color, may readily be stained any desired color to harmonize with other woodwork.

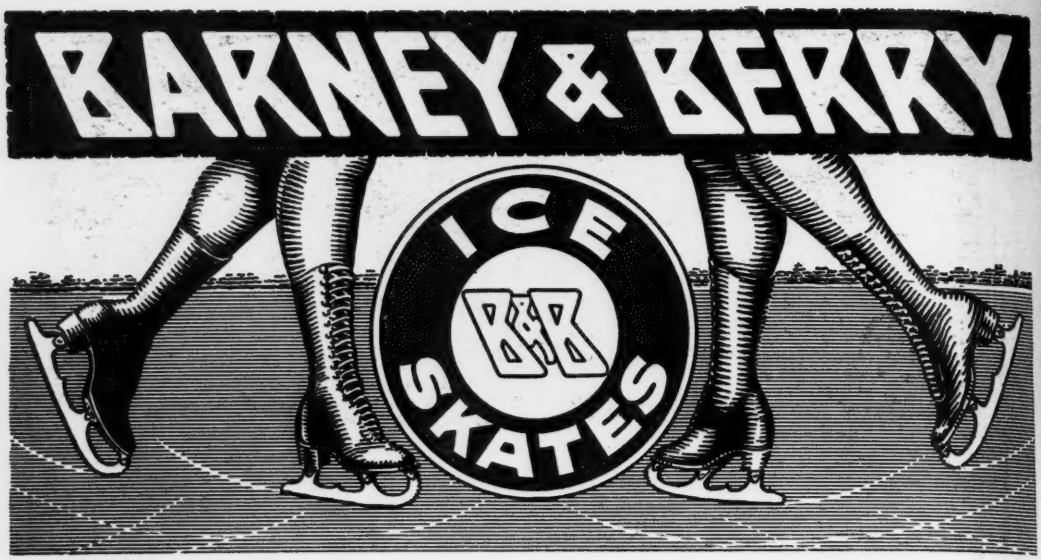
Edge-Grain Southern Pine Flooring is quarter-sawed. Only the edge of the grain is exposed to the tread, making it very durable under severe usage. It will not sliver, buckle or curl; wears slowly and evenly; it is not affected by frequent wettings.

Edge-Grain and Flat-Sawed Southern Pine Flooring may be obtained everywhere east of the Rocky Mountains. Its lower cost is due to the fact that the wood is so very plentiful.

"Beauty Plus Service in Floors," is the title of a handsomely illustrated booklet, sent free on request. If you are building, you should have this booklet. Address Dept. J-62.

Southern Pine Association

NEW ORLEANS, LA.



SKATES YOU CAN DEPEND ON

THESE are the days when ice skating, the king of winter sports, calls to every red-blooded man, woman and child to get into the game and enjoy the keen zest and exhilaration of gliding over the frozen stretches of river and lake. To get the maximum of enjoyment from skating, however, one needs sturdily constructed, sharp-bladed skates.

Barney & Berry skates are the logical choice of all who want the best in equipment. For more than fifty years Barney & Berry skates have been famous for their intrinsic value and beauty of design. The product of master skatecrafters, they are built with the needs of the skater ever in mind, and every pair is tested to insure the wonderful stay-sharp quality that has distinguished Barney & Berry skates for half a century.

BARNEY & BERRY MEMBER SKATERS' LEAGUE

FOR THE BOYS

Be a member of the B & B Skaters' League. Nothing to pay. Fine lapel button sent to you by Barney & Berry when you join. Learn about this at once. It's too good to miss.

FREE

BOOKLETS on "How to Skate," "B & B Skaters' League" and complete Illustrated Catalog of B & B Ice Skates mailed to you FREE if you will send your name and address to us.

There are forty and more styles of Barney & Berry skates for you to choose from; forty and more styles with keen, temper-tested blades of flawless steel that make their possession a source of satisfaction and pride to anyone who appreciates worth.

Somewhere in the Barney & Berry line there is just the skate to fill your particular need. Somewhere in your town there is a merchant who is anxious to serve you with the best. He has Barney & Berry skates, and will gladly help you in the selection of a pair that will meet your every requirement.

BARNEY & BERRY, Inc.

1093 Broad Street
SPRINGFIELD, MASS.

Make this Christmas "the best ever" for your boy

You remember, don't you, how much you wanted a gun, how discontented you were till you got it? And will you ever forget how proud and happy you felt the first time you fitted the stock of your *own* Winchester to your shoulder and fired your first shot? Well, that lad of yours wants a rifle of his own just as badly as you ever did and—

Now's your chance to make him happy

Christmas is the time to make his most cherished dream come true, and that Winchester .22 will give him more pleasure this year than a whole arsenal of them could possibly give him five years from now. So make him happy while you have such a good chance.

A rifle is a wise gift, too, because it brings out the man in him; it teaches him responsibility, self-control, self-reliance; it develops in him the invaluable qualities of concentration and perseverance.

Every boy knows the reputation behind the name "Winchester," so get him the rifle he can be most proud of.

What the name "Winchester" means

The name "Winchester" stands for the best in gun making. For over half a century Winchester has been the standard of pioneers and sportsmen.

The Winchester Company today is an organization of expert gun makers with 50 years of gun-making reputation behind it.

Every gun or rifle that bears the name "Winchester" is fired many times for smooth action and accuracy, and is fired with excess loads for strength.

Get the rifle now

Your dealer will help you to decide which one of the fine .22 Winchesters will best suit your boy. Now is the time to select it—while there are still plenty in stock. You will be surprised to find what a fine gun you can get for a low price. Get the rifle now and make the boy happy.

There is a place near you, either out in the open or at a club, where you can shoot. If you do not know where to shoot, write to us, and we will tell you where and how you can, or we will help you organize a club.

WINCHESTER REPEATING ARMS CO.
Dept. 89 New Haven, Conn.

Boys and Girls

Winchester Medals for skill with the rifle

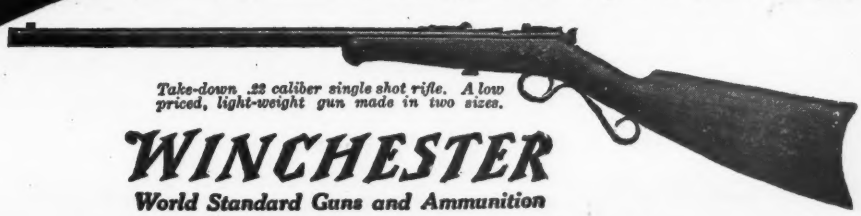
The Gold Plated "Sharpshooter" Medal goes to the boy or girl under 18 who makes the first grade score with a Winchester .22 rifle and Winchester ammunition.

The Silver Plated "Marksman" Medal goes to the boy or girl who makes the second grade score.

Go to your dealer today; he will give you a sample target and booklet explaining the full conditions of the contest. This booklet also tells you how to get the best results from your Winchester. The dealer will also supply you with targets.

If your dealer cannot supply you, write to Winchester Repeating Arms Co., Dept. 89, New Haven, Conn.

MODEL 06. Take-down Repeating .22 caliber rifle, 20-inch round barrel. Shoots three sizes of ammunition. The most popular .22 caliber repeater ever placed on the market.

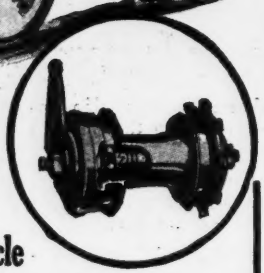


Take-down .22 caliber single shot rifle. A low priced, light-weight gun made in two sizes.

WINCHESTER

World Standard Guns and Ammunition

It requires ten minutes for a locomotive to develop its maximum speed, yet owing to the tremendous power of the Air Brake it can be brought to a complete stop within 22 to 24 seconds.



What the Air Brake is to the Locomotive the Corbin Duplex Coaster Brake is to the Bicycle

Experienced cyclists the country over can testify to the reliability of this most famous of all coaster brakes. For seventeen years it has been recognized as the standard brake equipment and during that time it has been developed to the highest state of brake efficiency.

The Corbin Duplex answers every demand the rider may make on it. With Corbin equipment he has at all times complete control over his bicycle. No grade is too steep and no corner too sharp. Complete ball bearings throughout minimize friction and assure that smooth, easy action for which the Corbin Duplex has always been noted. The large brake surface provides a powerful grip, enabling the bicycle to be brought to an instantaneous or gradual stop as the occasion demands.

A slight pressure of the foot is all that is required. When coasting, the feet remain at rest and always in a convenient position to apply the necessary control.

Carefully constructed, handsomely finished, the Corbin Duplex will outlive the sturdiest bicycle and stand up under the most rigorous service.

When purchasing your new bicycle specify and insist upon the Corbin Duplex. Now is the time to do it. Equip it to your old wheel—it makes all the difference in the world.

Corbin Control Means Safety Assured

BOYS *send today for this handsome Liberty Pin—It is* **FREE**

Fill in the coupon as indicated and send it to us and by return mail we will send you this attractive souvenir. Write for this pin today. You will be delighted with it as is every boy who has seen it.

Just out! The new 1918 fully illustrated catalog. You should have one. Write for it.

The Corbin Screw Corporation, The American Hardware Corporation, Successor, 202 High St., New Britain, Conn.

Dear Sirs: Please send me handsomely colored Liberty Stick Pin.

The name of my bicycle is—.....

.....

My name .....

Street .....

City.....

State .....

HERMAN'S U.S. ARMY SHOES

Munson Last

Accurately following the outline of the arch, **Herman's Munson** makes allowance for muscle action and natural expansion and allows the foot to do its part without pain or injury. It corrects foot troubles and adds to your **sure-footedness** and **efficiency.** Every U. S. soldier has to wear it. Every civilian whose feet are complaining will find in this shoe **blessed relief** and **matchless footwear value.** All sizes and widths.

Wear Herman's

Write for the name of a Herman dealer near you. Or you can buy from us by mail—fit and satisfaction guaranteed. Munson's black or tan, $7. Look for the shield trade mark on the sole.

Catalog of All Styles

FREE—Write for it.

Jos. M. Herman Shoe Co.

Army Contractors

802 Albany Bldg., Boston, Mass.

HERMAN'S U S ARMY SHOE

MUNSON ARMY LAST

Old Furniture Made New

Don't be troubled because use takes the new look from your furniture---just bring the "new look" back with 3-in-One oil! Simply wring out a cloth in cold water, add a few drops of

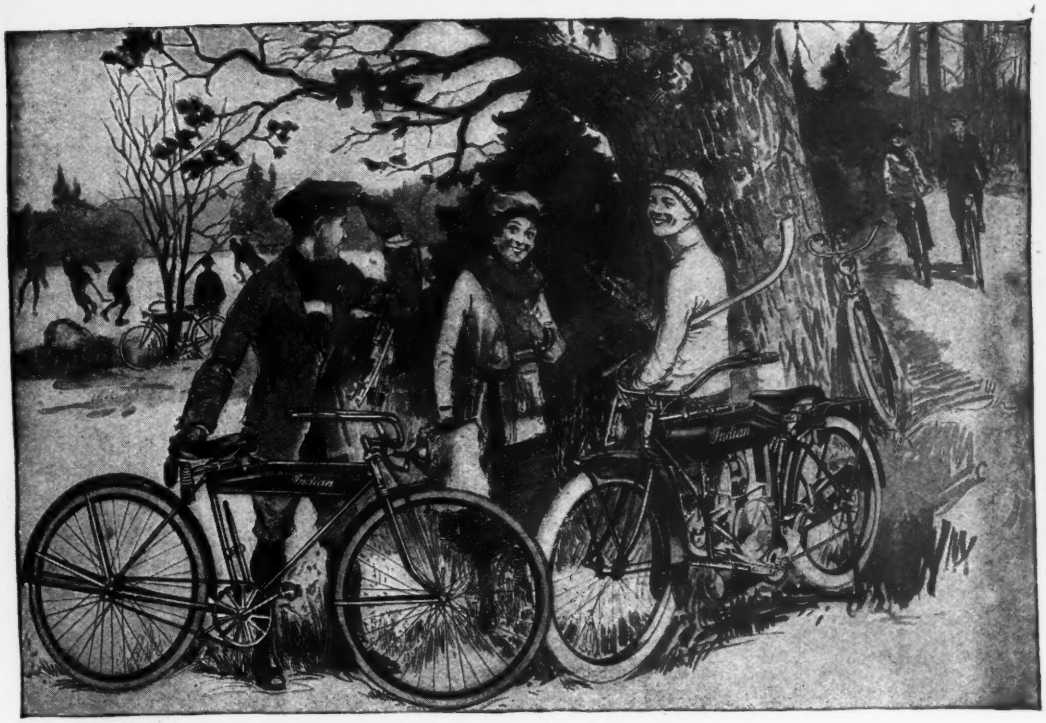
3-in-One Oil

and wipe, going over but a little surface at a time. Dry and polish with a woolen cloth or a cheese cloth, being careful to rub with the grain of the wood. Results are startling! Things that bore the outward signs of age—smoke stains, finger marks, grime, and scratches—look almost like newly purchased goods and grace your home as though they were. 3-in-One never turns rancid or gets gummy. Contains no acid; has no disagreeable odor.

1oz. 15c; 3 oz. 25c; 8 oz. (½ pt.) 50c. Also in Handy Oil Cans, 3 oz. 25c. If your dealer hasn't these cans, we will send one by parcel post, full of good 3-in-One for 30c.

FREE---Write for a generous free sample and the 3-in-One Dictionary.

Three-in-One Oil Co. 165KCF. Bdwy. N. Y.



The BEST Solution of the Youngsters' Christmas Gift Problem

NOT a soon-forgotten toy or worthless trinket, but an economical, practical, body-building, muscle-making 1918 *Electrically Equipped*

Indian Bicycle

Any boy or girl will glory in the possession of this most popular bicycle. Large Electric Light with Reflector, a necessity in those States requiring that bicycles be lighted; Tank Battery Holder, Triple Stem Forks, Indian Crank Hanger, motorcycle style lines throughout. Everything in equipment a bicycle should have.

Eleven other models in the 1918 Indian line, ranging in price from $27.50 to $50. All backed by the Indian nameplate and guarantee.

***1918 Indian Light Twin Motocycle*—Easily-handled, safe, dependable, mechanically simple motorcycle of modified speed and power. Has all the qualities of Indian super-construction and excellence, plus the Indian's recognized features of operating and upkeep economy. Priced to make it available for anybody who can afford any sort of high-grade two-wheel vehicle.**

Give the youngsters what they want—*Indians*. Practical, economical, healthful, they furnish fun and happiness and splendid outdoor exercise the year round.

Send for illustrated Bicycle or Light Twin Catalog, or both

HENDEE MANUFACTURING COMPANY, 725 State Street, Springfield, Mass.
(Largest Manufacturers of Motorcycles in the World)

Lord Elgin—

$100-

21 Jewels
8 Adjustments
Ultra Thin
Solid Gold

The watch of a gentleman.

Sterling character, in classic design, dressed in solid gold.

The newest and finest of a fine old line. A titled timepiece, whose possession instantly brands you a connoisseur.

A priceless heirloom—the gift that lasts a lifetime.

No man can know the fullness of *pride of possession,* till he owns the $100 Lord Elgin.

ELGIN NATIONAL WATCH CO., ELGIN, U.S.A.
Designers and Producers

When writing to Advertisers please mention Popular Science Monthly

COMMUNITY PLATE

New De Luxe GIFT CASES

GIFT SUGGESTIONS — *Sets of* COMMUNITY PLATE *in the beautiful* COMMUNITY GIFT CASES *of imported seal-grain leatherette. Any of the exquisite* COMMUNITY *designs can be obtained in similar cases, at prices ranging from* $3.25 *for a two-piece set, to the table service at* $53.00. *Of dealers everywhere. At your service for fifty years.*

ONEIDA COMMUNITY, *Ltd.*

A Motor Car Built By Craftsmen

LET men who have always built the most luxurious, and, incidently the most expensive custom-built motor cars, design a car at a "happy medium" price—and they will very likely achieve the unusual—turn the prevailing standards topsy-turvy. And this is what has happened in the case of the Pan-American, "The American Beauty Car".

Built by designers, engineers and production men who have previously produced the most beautiful, most expensive motor cars in America, the Pan-American is a distinct innovation in automobile craftsmanship—a motor car with those finer features which have hitherto distinguished only the very expensive car, or those of foreign build. A motor car like no other in America,—low-slung, roomy, *svelte* design; specifications that read like a veritable "blue book" of materials. *The car with the white radiator.*

Every motorist, or prospective motorist in America, should write for the beautiful Pan-American book, No. 2.

General Sales Offices

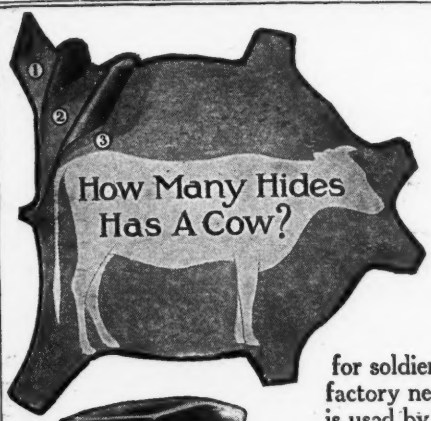
PAN-AMERICAN MOTORS CORPORATION, CHICAGO

Factory at Decatur, Illinois

Pan-American

"The American Beauty Car"

DU PONT AMERICAN INDUSTRIES



Uncle Sam Knows the Real Answer:

NOT ENOUGH!

SAVE LEATHER

For Soldiers

TO make America's hide supply go as far as possible, hides are being split into five or more thin sheets; but, even this saving scheme fails to meet the requirements for soldiers' shoes, harness, equipment, ship upholstery, factory needs, etc., chiefly because too much hide leather is used by the public in places where high grade leather substitutes will serve as well or better.

For Automobile Tops and Upholstery

For Boat Cushions and Upholstery

For Furniture Upholstery

For Bags, Trunks and Suitcases

For Book Binding

For Home Decorations. Novelties, Belts, etc.

Uncle Sam Has Set the Pace

The new U. S. motor trucks and ambulances will be upholstered in leather substitutes. For several years the standard for book binding in the Government Printery has been Du Pont Fabrikoid.

The upholstery specifications for the new Merchant Marine call for

DU PONT FABRIKOID
REG. U.S. PAT. OFF.

Craftsman Quality

What Uncle Sam has found by experience and tests good enough for the Government's severe requirements should be good enough for every loyal American.

How You Can Help

If you are a manufacturer using leather probably part or all of your requirements can be met by some grade of Fabrikoid. While not feasible for every use of leather, the illustrations herewith show its wide range of utility.

If you use leather in your home for any purpose, try the proper grade of Fabrikoid instead.

When buying an automobile, boat or piece of furniture prefer Fabrikoid upholstery. Help the manufacturer conserve leather by patronizing those who use good leather substitutes like Fabrikoid.

Every hide displaced by a good substitute helps supply our armies with shoes, our farms with harness and our factories with belting—it helps win the war.

Manufacturers! write us your requirements and let us co-operate with you.

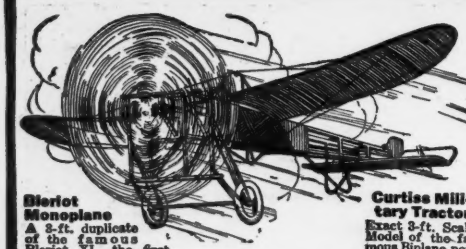
Americans everywhere! write for samples and names of manufacturers of the article you want, who use Fabrikoid and of stores near you selling it by the yard.

DU PONT FABRIKOID CO. Wilmington, Del.

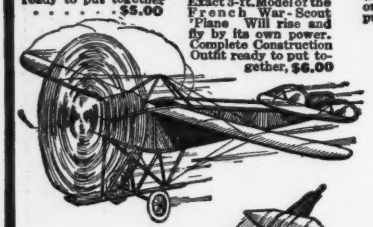
World's Largest Manufacturers of Leather Substitutes

Factories at
Newburgh, N. Y.; Fairfield, Conn.: Toronto, Ont.

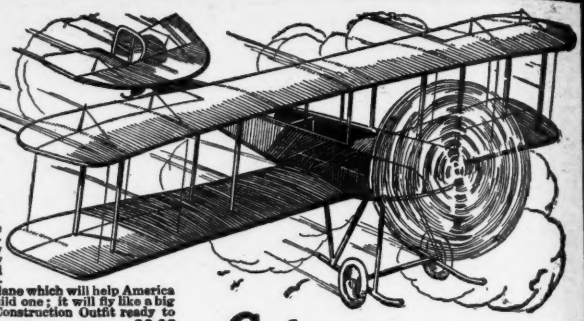
DU PONT



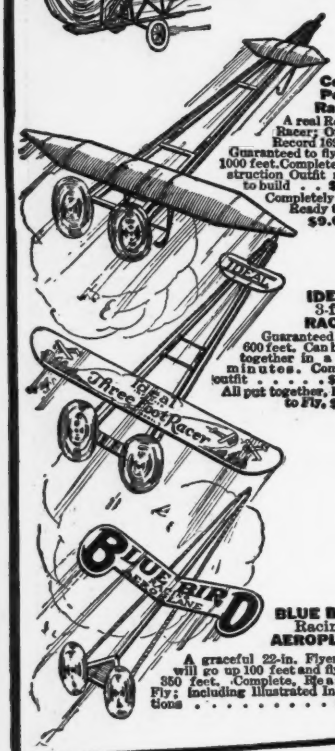
Bleriot Monoplane
A 2-ft. duplicate of the famous Bleriot XI, the first Aeroplane to fly across the English Channel. Will fly 100 ft. Complete Construction Outfit ready to put together $5.00



Nieuport Monoplane
Exact 3-ft. Model of the French War-Scout 'Plane. Will rise and fly by its own power. Complete Construction Outfit ready to put together, $6.00



Curtiss Military Tractor
Exact 3-ft. Scale Model of the famous Biplane now used by U. S. Army Aviation Corps and by the English aviators. The Aeroplane which will help America win the war! Build one; it will fly like a big one. Complete Construction Outfit ready to put together $6.00



Cecil Peoli Racer
A real Record Racer; Official Record 1691 ft. Guaranteed to fly over 1000 feet. Complete Construction Outfit ready to build . . $4.00
Completely Built Ready to fly, $9.00

IDEAL 3-ft. RACER
Guaranteed to fly 600 feet. Can be put together in a few minutes. Complete outfit $2.75
All put together, Ready to Fly, $4.00

BLUE BIRD Racing AEROPLANE
A graceful 22-in. Flyer that will go up 100 feet and fly over 350 feet. Complete, Ready to Fly; including illustrated Instructions $1.50

Get an IDEAL Model Aeroplane for Christmas

It's great sport to build and fly Model Aeroplanes! You can study the wonderful Science of Aviation and learn how Aeroplanes are built and how they fly. It's the most fascinating fun you ever had, and a most useful and patriotic thing to do. It's easy to

Build and Fly Your Own 3-ft. Models of Famous War Aeroplanes

that look exactly like big ones; that have rubber-tired disc wheels; adjustable planes and rudder; hand carved propeller; ball-bearing propeller shaft and other parts and fittings just like a *real* Aeroplane. These Model Aeroplanes fly like big ones; rise from the ground by their own power and fly 75 to 100 feet. It's easy to build them. Get an IDEAL Model Aeroplane Construction Outfit containing all the parts and full plans and instructions. All you have to do is put the parts together and build your own 3-ft. Model.

Tell your folks you want an IDEAL Model Aeroplane for Christmas—pick out the one you want now!

IDEAL Racing AEROPLANES and Flying Toys are Great Sport!

Racing Aeroplanes that go "sky-high"; fly far, fast and with, against or across the wind. Flying Toys that are just the thing for younger boys. Six different kinds. Three shown at the left. Here are four more; complete and ready to fly:—

IDEAL Speed-O-Flyer (2-ft. Racer)	$1.75
IDEAL Speed-O-Plane (1-ft. Flyer)	.75
IDEAL Loop-the-Loop Glider—Fibre Planes . .	.30
IDEAL Loop-the-Loop Glider—Wood Planes .	.50

How to Get These Aeroplanes

IDEAL Model Aeroplanes, Racing Aeroplanes and Flying Toys are sold by Leading Toy, Sporting Goods and Department Stores. Ask at **your** store for the ones you want. Ask for **"Those IDEAL Aeroplanes"!** If not obtainable there, we will fill your order, delivery charges prepaid, upon receipt of price if you mention your store's name and address.

IDEAL AEROPLANE & SUPPLY CO.
30-36 West Broadway, New York City

For 25 cts.

we will send you Accurate Scale Drawings, with Building and Flying Instructions, for any *one* of the Aeroplanes listed below. With these Plans and your own materials you can easily build a Model Aeroplane.

Curtiss Military Tractor
Curtiss Hydroplane
Bleriot Monoplane
Nieuport Monoplane
Taube Monoplane
Curtiss Flying Boat
Cecil Peoli Racer
Wright Biplane
All 8 Plans for $1.75

For 5 cts.

we will send you the IDEAL 48-page Aeroplane Book which tells all about Model Aeroplanes, and how they are built; about Racing Aeroplanes and Flying Toys; and lists all kinds of parts, supplies and materials for Amateur Aviators. If you want to know more about IDEAL Model Aeroplanes, send 5 cents in stamps and get this book. Tear off this corner and write your name and address in the margin. Do it now, so you won't forget.

GILBERT TOYS

Hello Boys!

REG. U.S. PAT. OFF.

Here's a straight tip for you. You don't have to be told about the loads of fun you can have building models of battleships, flying machines, cranes, skyscrapers, farming machinery, etc. Every regular fellow knows it. But—the important thing to keep in mind when buying a construction toy set is: Will your models look real—will the battleship that you build look like a regular member of Uncle Sam's floating flotilla, or will you have to hang a sign on it saying, "This is a battleship?" You know, making Erector what it is, has been serious to me. I guess I've never got over being a boy, myself. I know the importance of having things genuine. Most toy-makers are satisfied to get the first impression. But I know how a boy feels—when he realizes his toy isn't true—that the steel-work in his toy skyscraper isn't like the real building he saw or that his toy engine won't work—why he's hurt! He's done with it! Fellows! I know what I'm talking about when I tell you to be sure to get

GILBERT ERECTOR

REG. U. S. PAT. OFF.

"The Toy Like Structural Steel"

and there are hundreds of thousands of other fellows who will second my motion. The square four-sided Erector girder is *the* thing—it's in a class by itself—it's absolutely necessary if you want models of battleships that look like battleships, skyscrapers that look like skyscrapers, and hundreds of other models that look just like the things they represent. What's the use of building stuff if it doesn't look real? The answer is: Get Erector!

Look at the battleship shown here. Isn't it a crackerjack with its skeleton fighting turrets and gigantic guns that can be turned in any direction? Wouldn't you enjoy building it — wouldn't you be proud to show it to your friends? There's no limit to the fine things you can build with Erector, and no limit to the size of your models because you can constantly add to your first set with new Erector parts. Boys, tell your parents you want Erector this year for Christmas.

Learn all about the Gilbert Engineering Institute for Boys—how you can get free membership in it and win handsome Diplomas, Degrees, Gold Fraternity Pins, Gold Watches, Thirty Dollars in Salary, etc. Mail back the coupon now for a free copy of my beautiful book "How to Become a Gilbert Master Engineer," which tells the whole interesting story, and I will also send you a free copy of my magazine for boys, "Gilbert Toy Tips."

A. C. Gilbert
President

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ELECTRICAL SETS
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NEW HAVEN, CONN.

Send me a copy of "Gilbert Toy Tips" and your booklet, "How to Become a Gilbert Master Engineer."

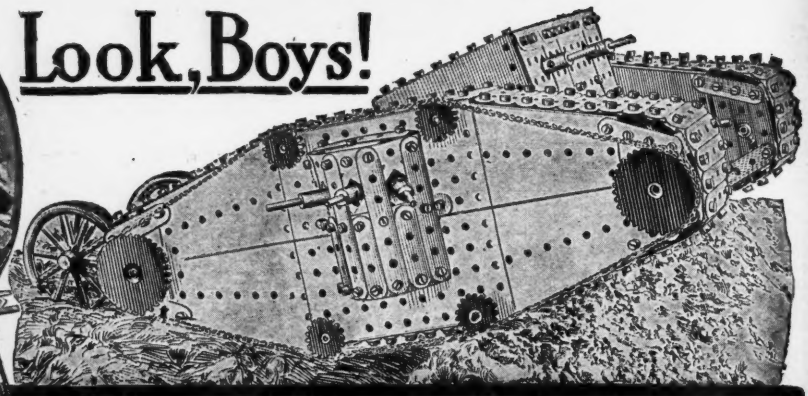
Name.....

Street.....

City.....

State.....

Look, Boys!



A set of Meccano is just like a Magic Box of fun!

You Can Build This TANK with MECCANO

Toy Engineering for Boys

Think of the never-ending joy of building with Meccano! You can construct Towers with electric elevators, Cranes that lift loads, Bridges that open and close, Steam Shovels that dig, Looms that weave, Clocks that keep time.

Or—you can reproduce the machines you see everywhere around you. There's no limit to what you can do. Why, it's almost magic! You can actually have a new toy every day.

The "Tank" shown above is a perfect working model of the wonderful machines which crawl over trenches and shell-holes, knock down trees and houses, and climb right over them. Yet it's only one of the hundreds pictured in the Meccano Manuals, which come with the Meccano sets. Each page is a fund of wonder; each model an inspiration.

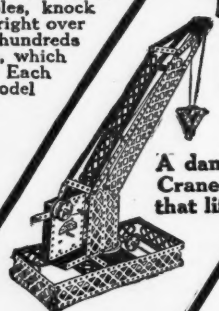
Send For Meccano Wonder Book

Send the name and address of yourself and three boy friends and you will receive the Wonder Book, telling all about Meccano; a free trial subscription to "The Meccano Engineer;" and terms of $1,000 Prize Contest. Send now, so you and Dad can decide on your present.

A few of the Hundreds of Models Any Boy can Build With Meccano.

A regular Army Aeroplane

A Steam Shovel that digs



A dandy Crane that lifts

A bully Field Gun

You can make a new model every day with Meccano if you want to. You never get tired of Meccano, and it never wears out.

Be Sure the Name "MECCANO" is on the Box

Insist on Meccano for Chrismas Because:

—Meccano Building is True Engineering.

—No Other Toy will make such Fascinating Models.

—Meccano Models operate like Real Machinery.

—You don't need to Study; the Fun begins when you open the box.

—There is no Limit to the Number of Models any Boy can Construct.

—Each Set is Complete; nothing more to Buy.

—You can Win a Big Cash Prize.

BE SURE YOU GET MECCANO

Be sure to get MECCANO. There isn't anything else just as good or just the same. So say the name over to yourself—MECCANO—MECCANO—MECCANO. Then tell Mother and Dad why nothing else will give you as much fun.

Prices of MECCANO Sets

MECCANO sets include various sizes of dandy girders, plates, and perforated strips; also nuts, bolts, wheels, gears and scores of other parts—all cut from shining steel and brass, as accurately as the works of a clock.
Each regular outfit, from No. 00 to No. 6, is complete with tools and full instructions. Nothing more to buy. Sets numbered 1X, 2X, 3X contain the powerful MECCANO Electric Motor. Any set sent postpaid upon receipt of price, if not at your dealer's.

No.	00	$1.00
No.	0	1.50
No.	1	3.00
No.	1X	4.50
No.	2	6.00
No.	2X	7.50
No.	3	9.00
No.	3X	12.00
No.	4	15.00

And up to $40.00

MECCANO COMPANY, Inc.
Building 10K, Bush Terminal, Brooklyn, N. Y.

Christmas Morning!

Give that boy or girl of yours a set of Anchor Blocks—a really wonderful architectural construction toy that will teach them while they are having real fun. These blocks are entirely different from ordinary blocks. They are made of stone in three natural colors—red brick, buff and blue slate—real building material. They last forever. They are a toy of constant wonders. They develop initiative and imagination. They offer the widest scope for the constructive tendencies that ought to be encouraged in every child.

RICHTER'S ANCHOR BLOCKS

Castles, battlements, bridges, forts, arches, houses, towers and all sorts of buildings arise as by magic under the child's hand. Each block is made in perfect relation to the others—architecturally exact and mathematically accurate. This permits adding other blocks to the set at any time so that larger and more elaborate models can be built

The many shapes of blocks in every set offer wonderful possibilities in building. There are no parts to rust or to hurt the child or tear its clothes, no parts to shrink or swell or fall apart. These blocks are at all times, in all climates—unchanging, correct, clean and everlasting. The models are easily dismantled. Just knock them over and start another. No time lost, no tiresome process to take them apart.

Catalog of these fine construction blocks sent on request. Sets from 50c to $5.00. Wonderful fortress sets, new this year, $1.50, $3, $6, $12. Fill out coupon and mail now or send money order if you wish to order right away.

Cut out coupon here

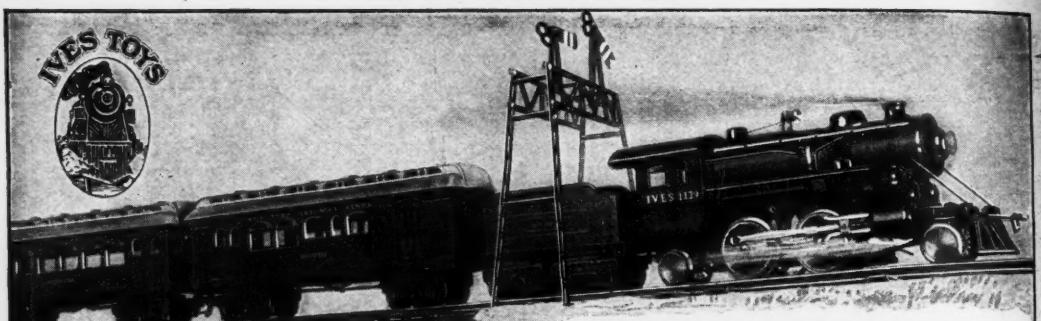
F. AD. RICHTER & CO., Dept. 81
74 Washington Street New York

Send me your booklet giving full particulars about Anchor Blocks.

Name .....

Address .....

City ..... State .....



Ives Toys
Make Happy Boys

Here you are, boys! Throw open the throttle of that big, powerful Ives locomotive, with its long, low, streamline body—the very latest type. Watch the big driving wheels spin. She's off! See her pull that train along. Now work that switch! She's crossing over! Press it again! She's slowing up! Now she's stopping at the station.

Get an Ives Train and track. Ask your folks for one for Christmas. Passenger cars, freight cars, coal cars, cabooses—just like real. Electric and mechanical locomotives—bridges and signals, etc. Write for FREE FOLDER today, and name of Ives dealer near you.

BOYS! GET THIS BOOK!

A really gorgeous book, with big pictures of trains in real colors and colored designs used on the cars. Tells about electricity and history of Ives Toys. Send five 2 cent stamps for it to pay postage, packing, etc.

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191 Holland Ave., Bridgeport, Conn.

I'm Ready for Action

I Am "Big Dick"

American Boys Attention!

I never miss fire.

I shoot thirty-six (36) wooden bullets as fast as you can turn the firing-crank. I shoot true as your aim and my strong iron base keeps me from "jumping".

For indoor war play I have no equal and will give you and your friends exciting fun storming the German Breast-works you can easily build.

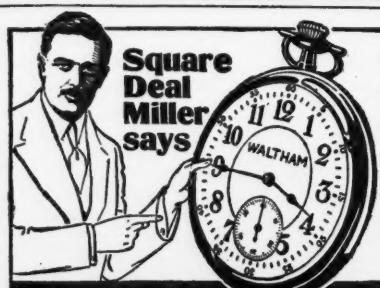
If you are a real live American Boy you will want me.

Tell mother and father I am not dangerous and just whisper to them that Christmas is coming.

You will find me at most toy dealers and well worth the $3.00 asked. If you don't find me at YOUR dealers send the price to my builders and they will send me direct to your home. Don't forget!

"BIG DICK"

MILTON BRADLEY COMPANY *(Builders of BIG DICK)*
Dept. G Springfield, Mass.
Makers of the World's Best Games



Any Watch YOU WANT *on* CREDIT

One Customer Writes: "I have had my watch just a year today and our watch inspector says its the best time keeper on the road. Please find enclosed my last monthly payment of $1.00." We have thousands of such letters on file from satisfied customers, who have bought from us on

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Oh BOY! if you want FUN

Lionel Trains are patterned after the big electric trains. They have fine, high-power, electric motor and are full of dash and go! Built with the weight close to the track so they won't derail; handsomely enameled—unbreakable—good for years of fun. Operate economically on batteries, or on house current with Lionel Transformer.

Ask Dad for a LIONEL Electric TRAIN for XMAS

$5 UP

Send for Big Free Catalog

—showing complete line of freight and passenger sets. Over 100 fascinating pictures. Tell Dad or Mother what you want and if not at your dealer's, I'll ship prepaid on receipt of price.

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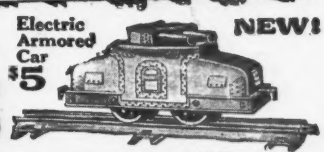
LIONEL ELECTRIC TOY TRAINS *& Multivolt Transformers*



NEW! Electric Armored Car **$5**

Price includes 8 sections "O" Gauge Track

BOOKS

"Practical Armature and Magnet Winding"

This book treats in a practical and concise manner this very important subject. All practical armature windings are fully explained with special attention paid to details. All questions which are apt to arise in the mind of the electrician have been completely answered. This book will prove a most valuable aid to the electrician, either in the constructing or operating department. Full Persian Morocco Leather, Pocket Size. Price, $1.50.

"20th Century Book of Recipes, Formulas and Processes"

This book gives you the information that represents the collection of years and the expenditure of thousands of dollars. Contains complete directions for making everything from simple glues and adhesives to the tanning of leather, the making of photographic materials, perfumes, soaps, plating of silver and gold, working of metals, etc. 800 Pages, 10,000 Subjects. Price, $3.00.

Popular Science Monthly, 225 West 39th St., New York

LIONEL MULTIVOLT TRANSFORMER

Runs All Kinds Of Electric Trains And Toys

ATTACHES to your house current, operates all electric toys and other small electrical apparatus; any graduation of power from 2 to 30 volts. This special $3.40 transformer is Lionel quality, high grade, all thru. Absolutely safe. If not at your dealer's, order direct giving us his name. We will ship, charges prepaid. Other models up to $8.00; send for catalogue.

$3.40

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Cheaper than Batteries

Builds More For Less Money

Makes 3 times as many real working models for the same money. Can be used many times. Start with 50c or $1.00 outfit. Add to your construction material as you learn to build—**only 50c per 100 ft.**

FLEXO-BUILDO

Varied colored patented thick, strong strips of flexible fibre. Can be bent two ways, cut in any number of equal lengths. Practical, inexpensive, serviceable. Taken down and set up without special tools. Makes permanent, useful, ornamental things: *Baskets, lamp shades, doll houses, etc., or mechanical models and toy bridges, engines, hoists, etc.*, which can be taken down.

Send for Free Catalog or Send $1.00

Get the free Flexo-Buildo book showing many models or send $1.00 for complete outfit (sent prepaid). Money back if you are not delighted when you see this Flexo-Buildo outfit.

GAYLORD BROS.

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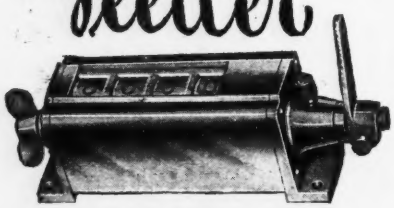
Syracuse, N. Y.

Now Industry Needs The Higher-Output Machine

—And any device that increases *production-rate* is invaluable to you who develop or operate machinery.

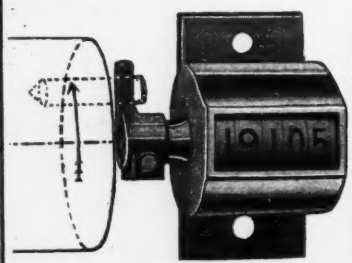
You can tell how improvements and developments affect output—how different operating methods compare in efficiency—when your machines are equipped with

Veeder



COUNTERS

Take the above **Set-Back Rotary Ratchet Counter:** it registers one for each reciprocating movement, recording an operation. By showing up the slightest gain in efficiency, it points the way to making the gain *bigger*. You reset counter to zero by turning knob. Price, with four figure-wheels, **$9.50.**



The **Revolution Counter** shown at left counts one for each complete turn of a shaft. Its action is smooth and uniform, and it will stand a very high rate of speed, which makes it especially suitable for experimental work. If run backward, this counter will subtract. Price, **$1.25.**

Practically any machine you're interested in can be furnished with a Veeder Counter —ask for Booklet 44.

THE VEEDER MFG. CO.
44 SARGEANT ST., HARTFORD, CONN.

A Merry Christmas for that Boy of Yours!

Your boy's Christmas will be the happiest ever, if you will send him THE BOYS' MAGAZINE. *It is a gift that lasts a whole year.* This splendid magazine is chock full of just the kind of reading *you* want *your* boy to have. Clean, inspiring stories by the best boys' authors. *Practical* and *instructive* departments devoted to Electricity, Mechanics, Athletics and Physical Training, Hunting, Camping and Fishing, Photography, Drawing, Stamp and Coin Collecting, Poultry and Pets, Boy Societies and Clubs, Joe Jolly's Joke Market, Cash Contests, etc. THE BOYS' MAGAZINE is beautifully illustrated throughout—each issue has a new handsome cover in colors. Get this great magazine for your own boy or for some boy in whom you are particularly interested.

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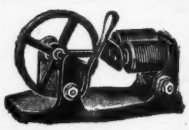

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Perfection Toe Spring
Worn at night, with auxiliary appliance for day use.

Removes the Actual Cause
of the enlarged joint and bunion. Sent on approval. Money back if not as represented. Send outline of foot. Use my improved Instep Support for weak arches.

Full particulars and advice free in plain envelope

M. ACHFELDT, Foot Specialist. Estab. 1901
MARBRIDGE BUILDING
Dept. 120, 1328 Broadway (at 34th St.) New York

The Tires on That Christmas Bicycle

are important. You know what the other fellows with bikes say about United States Tires. They're not only the snappiest looking tires made, but what's a lot more important, they wear longer and better on both city pavement and country roads.

Ten different treads from which to pick the one that you think will best fit your road requirements.

So when you ask Dad or Mother for a new bike for Christmas, don't forget to tell them you want it equipped with **United States Tires.**

United States Bicycle Tires Are GOOD Tires

UNITED STATES TIRE COMPANY
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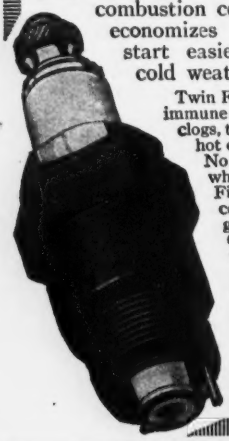
TWIN FIRE
The Only Plug That Fires

Two Distinct Sparks

Twin Fire Spark Plugs fire two independent sparks simultaneously. This adds vigor to the gas explosions, makes combustion complete, reduces carbon, economizes fuel and makes motor start easier and run better in cold weather.



Twin Fire plugs always fire. They are immune to soot and oil. If one point clogs, the other point still fires and the hot explosions clean the fouled one. No other multi-point plug will fire when even one point clogs. Twin Fires require less attention and cost no more than others, but give more dependable service. Get a set from your dealer, or write to us direct.

Dealers There's a big demand for this trouble-proof plug and our proposition is attractive. Don't stock up completely with ordinary plugs before investigating our offer. Write today for details.

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ON 30 DAYS FREE TRIAL

Adjusted 17 Jewel Elgin

This New Thin Model 17 Jewel Elgin is absolutely supreme where Reliability is a factor. Double sunk dial—Double Roller Escapement—Double strata 25 year Gold case. It's just the watch you've always wanted.

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Easy Credit Terms As Low As Just send your name and address for this New Elgin with our Special $5 Gold Chain Free, and our bed-rock confidential price will surprise and delight you.

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This book treats in a practical and concise manner this very important subject. All practical armature windings are fully explained with special attention paid to details. All questions which are apt to arise in the mind of the electrican have been completely answered. This book will prove a most valuable aid to the electrician, either in the constructing or operating department. Full Persian Morocco Leather, Pocket Size, Price, $1.50.

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"20th Century Book of Recipes, Formulas and Processes"

This book gives you the information that represents the collection of years and the expenditure of thousands of dollars. Contains complete directions for making everything from simple glues and adhesives to the tanning of leather, the making of photographic materials, perfumes, soaps, plating of silver and gold, working of metals, etc. 800 Pages, 10,000 Subjects. Price, $3.00.

Popular Science Monthly
225 West 39th St., New York

North Pole people and those in mid-African jungles do not use WHITING-ADAMS BRUSHES-because they do not use Brushes. Folks in other countries use Brushes, and prefer those made by

WHITING-ADAMS

BRUSHES and CIVILIZATION are INSEPARABLE

For OVER FIVE GENERATIONS, the users of ARTISTS' BRUSHES, PAINTERS' BRUSHES, TOILET BRUSHES, and ALL KINDS OF BRUSHES, have come to rely on WHITING-ADAMS for the best brushes of every style for every purpose. This confidence in WHITING-ADAMS BRUSHES has spread wherever Brushes are used.

Whiting-Adams Company makes the BRUSH YOU WANT

If not in your dealer's stock he will get it promptly

JOHN L. WHITING-J. J. ADAMS CO., Boston, U. S. A., Dept. O

Brush Manufacturers for Over 100 Years

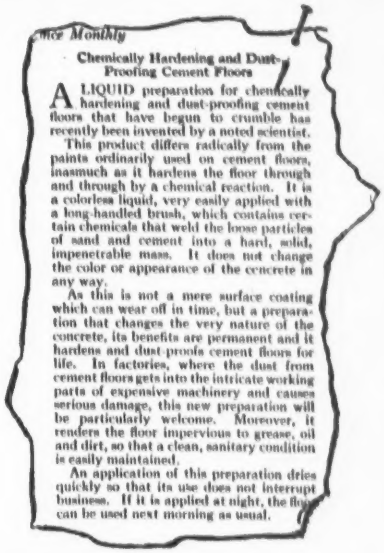
Whiting-Adams Brushes awarded Gold Medal and Official Blue Ribbon, the highest award at Panama-Pacific Exposition, 1915

Good news for owners and users of Concrete Buildings

If you have concrete floors—read this clipping. Learn how

LAPIDOLITH
TRADE MARK

will dust-proof and wear-proof concrete floors permanently. Flush this liquid chemical on old or new floors and save repairs and losses from concrete dust. Used for years. Applied under our direction. Write for proof and sample to Department A.



ence Monthly

Chemically Hardening and Dust-Proofing Cement Floors

A LIQUID preparation for chemically hardening and dust-proofing cement floors that have begun to crumble has recently been invented by a noted scientist.

This product differs radically from the paints ordinarily used on cement floors, inasmuch as it hardens the floor through and through by a chemical reaction. It is a colorless liquid, very easily applied with a long-handled brush, which contains certain chemicals that weld the loose particles of sand and cement into a hard, solid, impenetrable mass. It does not change the color or appearance of the concrete in any way.

As this is not a mere surface coating which can wear off in time, but a preparation that changes the very nature of the concrete, its benefits are permanent and it hardens and dust-proofs cement floors for life. In factories, where the dust from cement floors gets into the intricate working parts of expensive machinery and causes serious damage, this new preparation will be particularly welcome. Moreover, it renders the floor impervious to grease, oil and dirt, so that a clean, sanitary condition is easily maintained.

An application of this preparation dries quickly so that its use does not interrupt business. If it is applied at night, the floor can be used next morning as usual.

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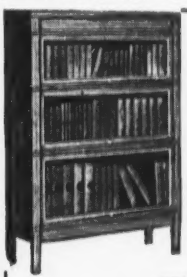

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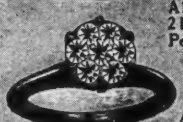

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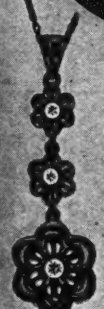

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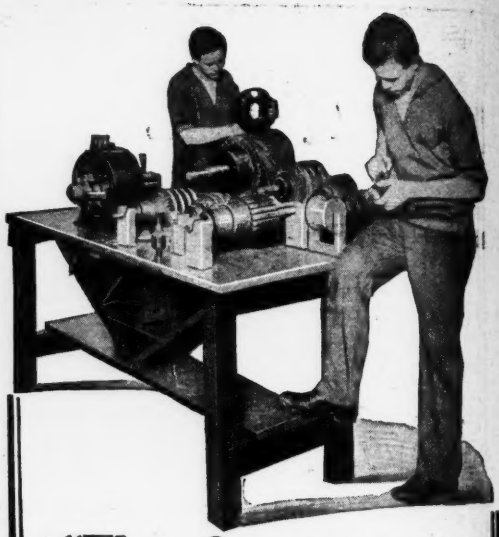

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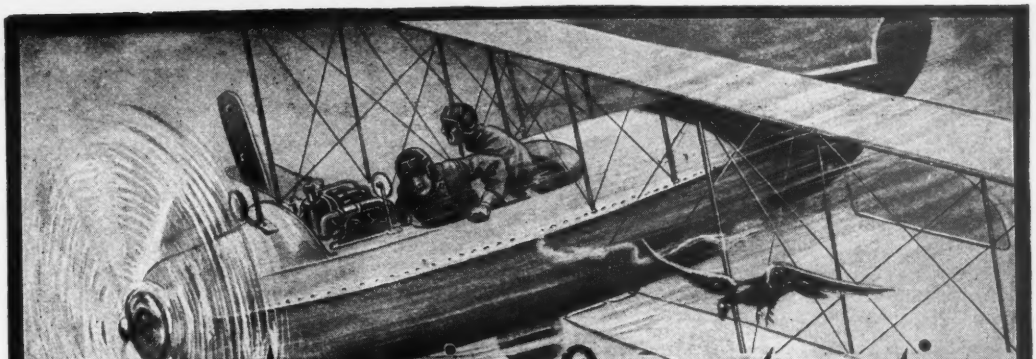

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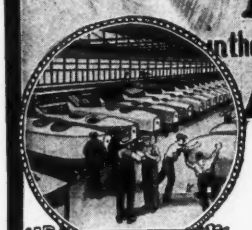

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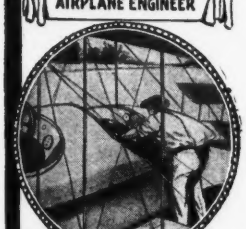

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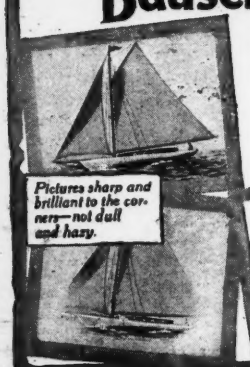

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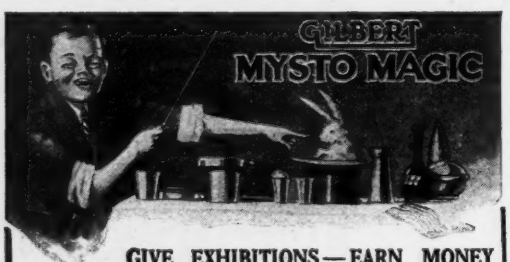

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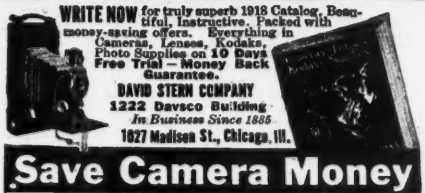

WRITE NOW for truly superb 1918 Catalog. Beautiful, Instructive. Packed with money-saving offers. Everything in Cameras, Lenses, Kodaks, Photo Supplies on **10 Days Free Trial — Money Back Guarantee.**

DAVID STERN COMPANY
1222 Davsco Building
In Business Since 1885
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Save Camera Money

BIG PROFITS with this BATTERY CHARGER

Hundreds of garage owners are clearing $20 to $60 profit every month with this 500-Watt H-B quick-charging equipment. Recharges one to seven batteries at a time, at cost of about 15c per battery. Autoist pays 75c to $1.50. At least $4.50 profit each capacity run.

$15 Puts This Money-Maker In Your Garage

Balance in eight monthly payments of $20 each. Earnings will quickly pay for machine. Every outfit fully guaranteed. Tear out this ad and send with name for full particulars.

HOBART BROS. CO., Box 12S, Troy, Ohio

HOME GUARD ARMY BARGAINS

20,000 Rifles	200 Machine Guns
5,000 Revolvers	100 B/L Field Cannons
5,000,000 Cartridges	**50 B/L Navy Cannons**
300,000 Equipments	15 Revolving Cannons
40,000 Knapsacks	50,000 Explosive Shells
2,500 Tents	25,000 Uniforms (Blue)

We have supplied from our **largest in the world stock of army auction goods, the U. S. Government and many states and cities** with obsolete serviceable rifles and equipments, some of which were sold to us just prior to the U. S. Declaration of War.

High Army Officers say: **"Bannerman's stock is a Godsend to us."**

Six hours after receipt of order from State of Massachusetts 4,000 rifles and 6,000 equipments were en route. Gov't auction sale terms, cash with order. Examination and testing at our arsenals. Immediate deliveries.

Large illustrated 428 pp. encyclopedia catalog, mailed 50c.

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Bring them joy!

Give a real

Flexible Flyer

The famous steering-sled with non-skid runners

You're bound to delight any boy or girl! It'll give them fun and vigor and health!

And it's just the sled they've wanted—with grooved runners of chrome nickel steel that prevent skidding, increase speed, and give easier control. With all-steel front that absorbs shocks and keeps wooden seat and hand rails from splitting. No dragging of feet to get wet and wear out shoes! Prevents colds and saves doctor's bills.

Outlasts 3 Ordinary Sleds

Strong and scientifically constructed. Nine sizes—3 to 8½ feet long. Sold by hardware and department stores.

S. L. ALLEN & CO. *Unless it bears this trade-mark it isn't a Flexible Flyer*
Box 905L Philadelphia

Free Offer. Send postal for cardboard model, which shows how Flexible Flyers steer.

When writing to Advertisers please mention Popular Science Monthly

What are you kicking about?

—You men who think you're underpaid

The men who get big pay are those who are ***trained*** to earn it. Your pay is small because you have no special training—***and you only are to blame.***

You can ***learn*** to ***earn*** more. No matter what your job, where you live or how old you are, if you can read and write, the International Correspondence Schools can train you for a ***better position*** and ***bigger pay.***

If you want to get out of the ranks of the "hard-ups" and be somebody, prove your ambition by marking and mailing the coupon on this page today. Thousands of others ***just like you*** who have used this coupon are now occupying positions of power and high pay. You can join them. ***Grit your teeth, say "I will" and mail the coupon NOW.***

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 5838, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

☐ ELECTRICAL ENGINEER	☐ SALESMANSHIP
☐ Electric Lighting	☐ ADVERTISING MAN
☐ Electric Car Running	☐ Window Trimmer
☐ Electric Wiring	☐ Show Card Writer
☐ Telegraph Expert	☐ Outdoor Sign Painter
☐ Practical Telephony	☐ RAILROADER
☐ MECHANICAL ENGINEER	☐ ILLUSTRATOR
☐ Mechanical Draftsman	☐ DESIGNER
☐ Machine Shop Practice	☐ BOOKKEEPER
☐ Gas Engineer	☐ Stenographer and Typist
☐ CIVIL ENGINEER	☐ Cert. Public Accountant
☐ Surveying and Mapping	☐ Railway Accountant
☐ MINE FOREMAN OR ENGINEER	☐ Commercial Law
☐ Metallurgist or Prospector	☐ GOOD ENGLISH
☐ STATIONARY ENGINEER	☐ Teacher
☐ Marine Engineer	☐ Common School Subjects
☐ ARCHITECT	☐ CIVIL SERVICE
☐ Contractor and Builder	☐ Railway Mail Clerk
☐ Architectural Draftsman	☐ AGRICULTURE
☐ Concrete Builder	☐ Textile Overseer or Supt.
☐ Structural Engineer	☐ Navigator ☐ Spanish
☐ PLUMBING AND HEATING	☐ Poultry Raising ☐ German
☐ Sheet Metal Worker	☐ AUTOMOBILES ☐ French
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Name _____

Occupation & Employer _____

Street and No. _____

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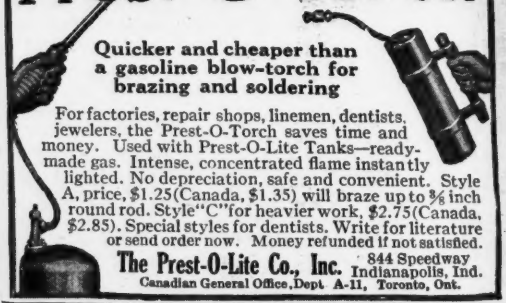
If name of Course you want is not in this list, write it below.

Acetylene Blow Torch

Prest-O-Torch



Quicker and cheaper than a gasoline blow-torch for brazing and soldering

For factories, repair shops, linemen, dentists, jewelers, the Prest-O-Torch saves time and money. Used with Prest-O-Lite Tanks—ready-made gas. Intense, concentrated flame instantly lighted. No depreciation, safe and convenient. Style A, price, $1.25 (Canada, $1.35) will braze up to 3/8 inch round rod. Style "C" for heavier work, $2.75 (Canada, $2.85). Special styles for dentists. Write for literature or send order now. Money refunded if not satisfied.

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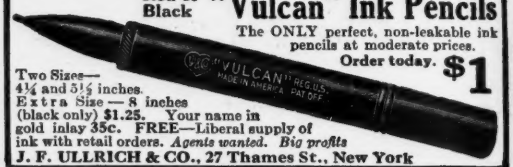
Red or Black **"Vulcan" Ink Pencils**



The ONLY perfect, non-leakable ink pencils at moderate prices.
Order today. **$1**

Two Sizes—
4¼ and 5½ inches.
Extra Size — 8 inches
(black only) **$1.25.** Your name in gold inlay 35c. FREE—Liberal supply of ink with retail orders. *Agents wanted. Big profits*
J. F. ULLRICH & CO., 27 Thames St., New York

Beautiful Christmas Kodak Enlargements for Gifts

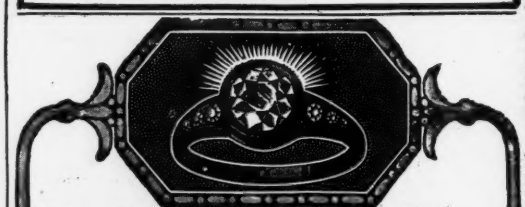
8x10 mounted, 35c. Send only the negative. **Best Kodak Developing**—any size roll for 10c and 6 prints **Free** with first roll. Or send 6 negatives, any size, and 10 cents for 6 prints. Ask for big catalog cameras, albums, etc.
Roanoke Photo Finishing Co., 213 Bell Ave., Roanoke, Va.

"Best" Hand Lantern

A powerful portable lamp, giving a 300 candle power pure white light. Just what the farmer, dairyman, stockman, etc. needs. Safe—Reliable—Economical—Absolutely Rain, Storm and Bug proof. Burns either gasoline or kerosene. Light in weight. **Agents wanted. Big Profits. Write for Catalog.**
THE BEST LIGHT CO.
475 E. 5th St., Canton, O.

You Can't Lose Pen or Pencil

Get this UP-TO-DATE combination clasp and yearly calendar. Prevents loss of pen or pencil. **Saves Time.** Best thing out. At all good stationers or from us—15c.
State for Pen or Pencil
ARGUS MFG. CO., Dept. A.
402 N. Paulina St., CHICAGO, ILL.
Send stamps or coin.

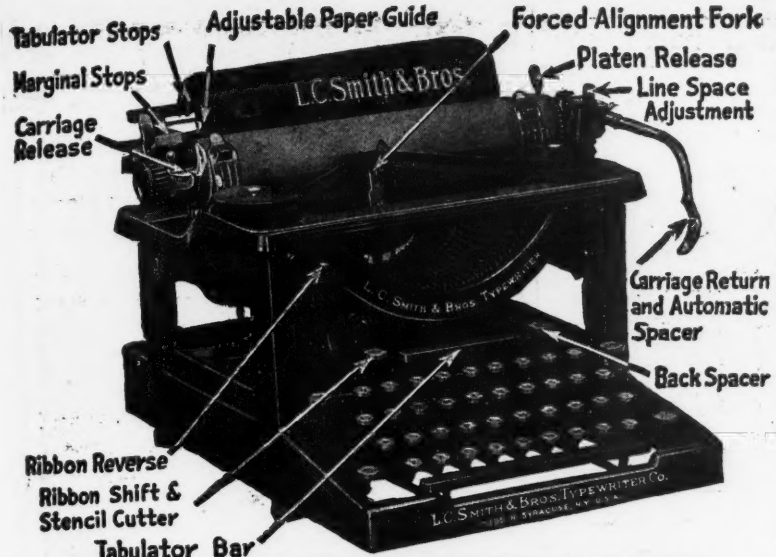


Try to Match at 60% More

A Startling Christmas Special. 1/2—1/8, 1/64 kt. exact guaranteed weight of this perfectly cut, genuine diamond of high degree of perfection, and satisfactory color, we feel sure. Gentlemen's 14-kt. solid gold mounting. Try to match at double our price. **Guaranteed Cash Loan $25.00. Unpaid Loan Price..... $29.00**
Liberty Bonds accepted as cash.

Write for Jos. DeRoy & Sons Bulletin

No obligations. Hundreds of unpaid loan bargains in diamonds and watches, offered by a House over 60 years in diamond banking business—rated over $1,000,000. *Special Christmas Offers* ready. Write today.
Jos. DeRoy & Sons (Only Opp. Post Office) 4733 DeRoy Bldg. **Pittsburg, Pa.**



I want, through this advertisement, to establish as friendly business relations with you as I possibly can. I want you to realize also, that it is my earnest effort and intention to give you full honest value for every dollar that you spend with me. This is the only way I can succeed. My advertisement has appeared in this magazine continuously for more than four years.

I am building up my business on the foundation of good value and square dealings. I am saving thousands of satisfied customers thousands of dollars, by supplying, perfect—late style—visible writing—typewriters, at remarkably low prices.

All my transactions are handled throughout by personal correspondence. I assure you every courtesy and consideration, in your dealings with me. Your order will have my prompt, careful, personal attention. I will be glad to do business with you.

Harry A Smith

ALL LATEST IMPROVEMENTS

TYPEWRITER SENSATION

Free TRIAL—Use As You Pay

Send me only $2.50 a month until the low total price of $48.80 is paid, and the machine is yours

This is absolutely the most generous typewriter offer ever made. Do not rent a machine when you can pay $2.50 a month and own one. Think of it—Buying a $100.00 machine for $48.80. Cash price, $45.45. Never before has anything like this been attempted.

STANDARD VISIBLE L. C. SMITH

Perfect machines, standard size, keyboard of standard universal arrangement—universally used in teaching the touch system. The entire line of writing completely visible at all times, has the inbuilt tabulator with billing devices, the two color ribbon—with automatic reverse and key controlled shift, automatic flexible paper feed—automatic paper fingers, the back spacer—ball bearing carriage action—ball bearing shift action—ball bearing type bars—in fact, every late style feature and modern operating convenience. Comes to you with everything complete, tools, cover, operating book and instructions, ribbon, practice paper—nothing extra to buy. **You cannot imagine the perfection of this beautiful reconstructed typewriter until you have seen it.** I have sold several thousand of these perfect latest style L. C. Smith machines at this bargain price, and every one of these thousands of satisfied customers had this beautiful, strictly up-to-date machine on five days' free trial before deciding to buy it. I will send it to you F. O. B. Chicago for five days' free trial. It will sell itself, but if you are not satisfied that this is the greatest typewriter you ever saw, you can return it at my expense. You won't want to return it after you try it—**you cannot equal this wonderful value anywhere.**

You Take No Risk—Put In Your Order *Now*

When the typewriter arrives deposit with the express agent $8.80 and take the machine for five days' trial. If you are convinced that it is the best typewriter you ever saw, keep it and send me $2.50 a month until my bargain price of $43.80 is paid. If you don't want it, return it to the express agent, receive your $8.80 and return the machine to me. I will pay the return express charges. **This machine is guaranteed just as if you paid $100.00 for it.** It is standard. Over one hundred thousand people own and use these typewriters and think them the best ever manufactured.

The supply at this price is very limited, the price will probably be raised when my next advertisement appears, so don't delay. Fill in the coupon today—mail to me—the typewriter will be shipped promptly. There is no red tape. I employ no solicitors—no collectors—no chattel mortgage. It is simply understood that I retain title to the machine until the full $48.80 is paid. **You cannot lose. It is the greatest typewriter opportunity you will ever have. Do not send me one cent. Get the coupon in the mails today—sure.**

HARRY A. SMITH, 306-231 N. Fifth Ave., Chicago

H. A. SMITH
Room 306-231 N. Fifth Ave.
CHICAGO, ILL.

Ship me the L. C. Smith F. O. B. Chicago, as described in this advertisement. I will pay you the $40.00 balance of the SPECIAL $48.80 purchase price, at the rate of $2.50 per month. The title to remain in you until fully paid for. It is understood that I have five days in which to examine and try the typewriter. If I choose not to keep it I will carefully repack it and return it to the express agent. It is understood that you give the standard guarantee for one year.

Name .....

Address .....

..... Pop. Sci. Mo. Dec.

"When I Buy My Diamond, What Security Is Given Me?"

THE ANSWER

THIS BOOK FREE

Write To-day

We sell diamonds of the finest quality at attractive prices. Buying diamonds direct and with less "overhead" than large, showy, expensive offices we offer better value for the same money. **To insure your confidence** in our claims and in the genuineness of our offer to refund full purchase price if you are dissatisfied, MASS. BONDING CO., a $1,500,000 corporation, **bonds every diamond we sell.** By this arrangement, in addition to our own certificate of guarantee, we give with each diamond purchase Mass. Bonding Co.'s certificate that the diamond is bonded with them and that if you are dissatisfied and return it within 30 days they guarantee YOUR MONEY BACK.

We are the first and only diamond merchant offering THIS DOUBLE BARRELLED SECURITY. Goods sent for inspection to your nearest bank or express office—without cost to you. Order safely by MAIL To-day. Ask for CATALOG No. 43.

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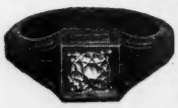
373 Washington St., Boston, Mass.
Diamond Merchants over 27 years.

Tells how to order diamonds and jewelry by mail without risk. *No money in advance.* Free examination of goods—no obligation. Write for free catalog No. 43, with latest supplement, which describes articles of distinctiveness and good taste in personal adornment.

Distinctive Gentleman's Ring



Large, brilliant diamond of splendid color. Handsome 14 Kt. Solid Gold mounting. Diamond set in Solid Platinum, Only $95

Do YOUR OWN Plumbing or Heating Our New EASY WAY Buy From Us Direct–Save ½

Send for Our Big Valuable
"Handy-Man" Book

Shows over 10,000 different fixtures and supplies in plumbing and heating goods at Wholesale, with our new easy adjustable installing features.

OUR HANDY-MAN BOOK shows and tells you how to properly install our new cut-to-fit STEAM, HOT WATER, or HOT AIR HEATING PLANTS, or plumbing outfits, and how to make any plumbing or heating repairs. Any handy man with a few ordinary tools, and the help of our free planning service, can properly do the work himself.

"Our New Hardin Easy Way"

To avoid sending this large 236 page, well-bound, valuable book broadcast, we ask a temporary deposit of 25c, which will be refunded on first order. Or if you are not satisfied, return book, and we will refund your money at once.

Every home owner, contractor, farmer, institution, etc., needs this BIG HANDY-MAN BOOK. **Write Today.**

HARDIN LAVIN CO.
40 Years at
4534-44 Cottage Grove Avenue
Dept. B, CHICAGO, ILL.

ACORN UNI-LITE FREE

Turns night into day. 300 candle power. Carry as a lantern; use anywhere as a lamp. Weather proof. For house, barn, garage, camp and around the farm. Write for *big free offer. Special opportunity to farmers, stockmen and motorists. Agents make big money.*

Write tonight for new 1917 offer
ACORN BRASS MFG. CO., 232 Factory Bldg., Chicago

ClassPins

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Free Book. 36 pages, 600 designs. Special designs made when desired. Save retailer's profits.

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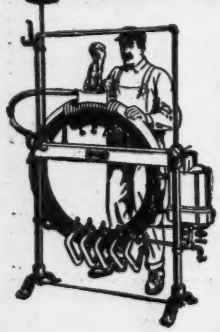
Ukulele Guitar, Mandolin, Hawaiian Guitar or Cornet

Yes, absolutely free to first pupils in each locality. We have the most wonderful, new, system for learning by mail to play by note, Piano, Organ, Violin, Mandolin, Guitar, Ukulele, Hawaiian Guitar or Cornet. Very small charge for lessons only expense. We guarantee success or no charge. Complete outfit free. Write now. No obligations.
Slingerland School of Music, Dept. 205, Chicago, Ill.

An Easy Way to Make Money



Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business and make $60 or more a week. One man made $45 the first day he received his outfit. **Others are making $25 a day and hundreds of wide-awake men are making $200 to $500 a month.**

No experience needed. We teach you how. Very little capital required. But slight risk, as every car owner in your town is a possible customer. Jobs are plentiful because tires blow out and puncture every day.

SHALER Tire Repair Outfit, $65

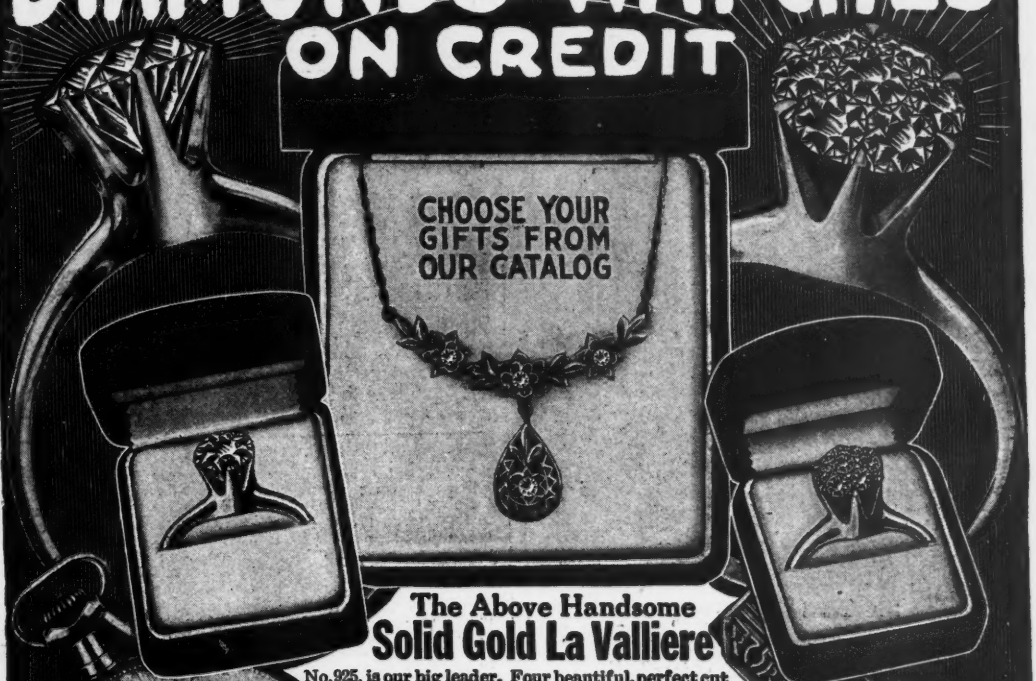
will do as much and as perfect work as the big $250 to $500 vulcanizing outfits. A boy can vulcanize perfectly with this simple machine. It's the only vulcanizer that has **Automatic Heat Control.** It must vulcanize just right. It can't undercure or overcure a tire. Requires no watching or regulating. You can learn to do expert tire vulcanizing in half an hour with the Shaler.

WRITE FOR FREE BOOK **"HOW TO OPEN A TIRE REPAIR SHOP"** and complete Catalog which gives full information.
WRITE QUICK BEFORE SOME HUSTLER GETS AHEAD OF YOU.

C. A. SHALER CO., 2111 Fourth Street, WAUPUN, WIS.

When writing to Advertisers please mention Popular Science Monthly

DIAMONDS-WATCHES ON CREDIT



The Above Handsome
Solid Gold La Valliere
No. 925, is our big leader. Four beautiful, perfect cut
Genuine Diamonds
$5 Down **$25** $2.50 a Month

Send for Free Catalog

There are over 2,000 photographic illustrations of Diamond Rings, Diamond La Vallieres, Diamond Ear Screws, Diamond Scarf Pins, Diamond Studs, Signet and Emblem Rings, Watches, Wrist Watches, Bracelets, Cuff Links, Brooches, Lockets, Chains, Charms, Silverware, Clocks, Toilet Sets; also our wonderfully showy assembled Solitaire Diamond Clusters.

Whatever you select will be sent, all shipping charges prepaid. **You see and examine the article right in your own hands.** If satisfied, pay one-fifth of purchase price and keep it; balance divided into eight equal amounts, payable monthly.

Tells All About Our Easy Credit System.

OVER 2000 ILLUSTRATIONS.

Send for Your Copy of This Catalog

Suggestions for Christmas Presents

A few of the many desirable articles shown in our large handsome Catalog. Every article listed below can be furnished at prices given and up to any price you wish to pay. All are popular selections, of exceptional value. We can fill any requirement.

Diamond Rings, Solitaire	$10 up	Diamond Cuff Links	$5 up
Loftis Solitaire Diamond Cluster Rings	$50 up	Diamond Scarf Pins	$3 up
Diamond La Vallieres	$10 up	Pearl Necklaces, Diamond-set Clasp	$3.50 up
Diamond-set Cameo La Vallieres	$12 up	Wrist Watches	$10 up
Diamond Brooches	$7 up	Watches, gold filled	$12 up
Diamond Ear Screws	$10 up	Bracelets, solid gold	$12 up
Diamond Studs	$10 up	Cameo Rings, Diamond-set	$12 up
		Vest Chains, solid gold	$12 up

21 JEWEL WATCHES That Will Pass Railroad Inspection $2.50 a Month

Our Catalog illustrates and describes all the new models—15, 17, 19, 21, 23 Jewels, adjusted. All sizes for men and women. Choice of popular designs. Our watches are guaranteed by the factory and further guaranteed by us.

Send for Catalog, make selections, and have as many articles as you wish charged in one account.

Any diamond purchased from us for a present may be exchanged for other selection at the full price paid, should the recipient desire to do so later on.

With this privilege you need have no anxiety in choosing gifts.

LOFTIS BROS & CO. EST'D. 1858

National Credit Jewelers
Dept. G871 108 N. State St., Chicago, Ill.

STORES IN LEADING CITIES

Thomas A. Edison

Mr. Edison's Wonderful New Phonograph

The world's greatest inventor has made the music of the phonograph life-like, at last. Success—after years of labor on his favorite invention! Read our offer on his wonderful new phonograph.

Only $1.00 and after trial

An astounding offer—the New Edison, Mr. Edison's great new phonograph with the new Diamond Stylus reproducer and your choice of all the brand new Diamond Amberol Records will be sent to you on free trial without a penny down. The finest, the best that money can buy at very, very much less than the price at which imitations of the genuine Edison are offered—a rock-bottom offer *direct* from us.

Entertain Your Friends

Hear all the latest up-to-date song hits of the big cities. Laugh at the side-splitting minstrel shows. Entertain your family and your friends with everything from Grand Opera to Comic Vaudeville—then if you choose, send the outfit back to us at our expense.

Rock-Bottom Direct Offer

If you wish to keep Mr. Edison's superb new instrument, send us only $1.00 after the free trial. Pay the balance on the easiest kind of monthly payments.

Think of it—a $1.00 payment, and a few dollars a month to get this outfit of Mr. Edison's new phonograph with the Diamond Stylus reproducer, the life-like music—the same Diamond Amberol Records—all the musical results of the highest priced outfits—yes, the greatest value for $1.00 down, balance on easiest monthly terms. Convince yourself—a free trial first! No money down, no C. O. D., not one cent to pay us unless you choose to keep the instrument.

To F. K. Babson Edison Phonograph Distributors 1209 Edison Blk. Chicago, Ill.

Gentlemen: Please send me your New Edison Catalog and full particulars of your free trial offer on the new model Edison Phonograph

Name.....

Address.....

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Our *New* Edison Catalog Sent *Free*

Your name and address on a postal or a letter (or just the coupon) is enough. No obligation in asking for the catalog. Get this offer—**while this offer lasts.** Fill out coupon today.

F. K. BABSON
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MAKE YOUR BIKE A MOTORCYCLE

at a small cost, by using our attachable outfit. Fits any Bicycle. Easily attached. No special tools required.

"Used His Four Years"

Harry A. Hyatt, of Boreas River, New York, writes: "About four years ago I received my motor attachment, and wish to say that I am satisfied with it in every way, for it has certainly given me good service. Anyone wanting a motorcycle or attachment, I would recommend them to the Shaw Manufacturing Co."

FREE BOOK Write today for bargain list and free booklet, fully describing the SHAW Bicycle Motor Attachment. Motorcycles all makes, new and second-hand, $35.00 up.

SHAW MANUFACTURING CO.
Dept. 169 GALESBURG, KANSAS

Statement of the Ownership, Management, Circulation, etc., required by the Act of Congress of August 24, 1912, of Popular Science Monthly published monthly at New York, N. Y., for October 1, 1917. State of New York, County of New York, ss. Before me, a notary public, in and for the State and county aforesaid, personally appeared O. B. Capen, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Popular Science Monthly and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are: Publisher, The Modern Publishing Company, Inc., 239 Fourth Avenue, New York, N. Y. Editor, Waldemar Kaempffert, 239 Fourth Avenue, New York, N. Y. Managing Editor, Waldemar Kaempffert, 239 Fourth Avenue, New York, N. Y. Business Manager, O. B. Capen, 239 Fourth Avenue, New York, N. Y. 2.—That the owners are: The Popular Science Publishing Company, Inc., 239 Fourth Avenue, New York, N. Y. Stockholders of Popular Science Publishing Company, Inc., Henry J. Fisher, 22 William Street, New York, N. Y.; Oliver B. Capen, 239 Fourth Avenue, New York, N. Y.; Robert Cade Wilson 683 Springfield Ave., Summit, N. J., Waldemar Kaempffert, 239 4th Ave., New York, N. Y., George B. Agnew, 22 William St., New York, N. Y., Susan D. Bliss, 22 William St., New York, N. Y. 3.—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: Importers and Traders National Bank, 247 Broadway, New York, N. Y.; H. J. Fisher, 22 William Street, New York, N. Y.; S. D. Warren and Co., 200 Devonshire St., Boston, Mass.; 4.—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) O. B. CAPEN, *Business Manager.*

Sworn to and subscribed before me this 2nd day of October, 1917.

Jos. Schwinger, Notary Public, Kings Co.; Certificate filed in New York Co. No. 513.

(Seal) My commission expires March, 1919.

If You Want an Electrical Book and don't know where to get it, write Book Department, Popular Science Monthly, *239* Fourth Avenue, New York City.

Get This Book BEFORE BUYING A TYPEWRITER We Save You Money

ALL MAKES $10 to $50

Why pay high prices for a typewriter when we can supply you with any standard make of machine at less than one-third the manufacturer's price? All machines rebuilt by the famous "Young Process." Every machine guaranteed and sold under a TEN DAY trial plan. Before investing a cent in a machine read our book. Catalog free. Send NOW.

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SUPERIOR SINCE 1904

Over 100,000 in Use

Mostly sold through recommendation

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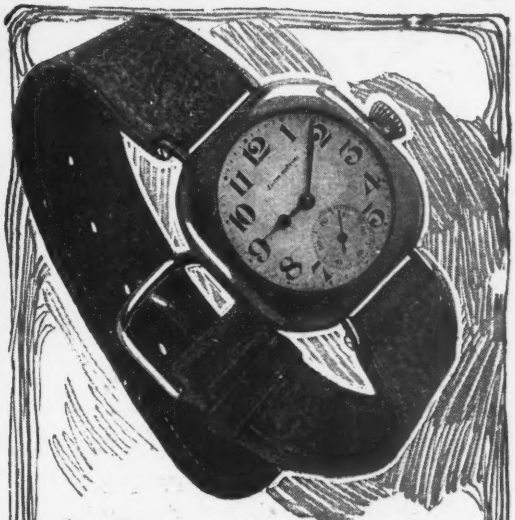

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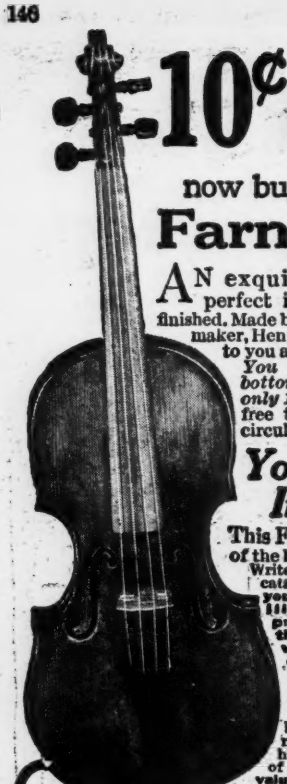

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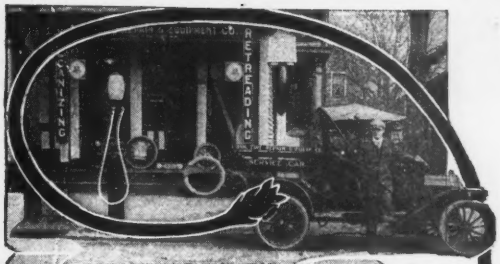

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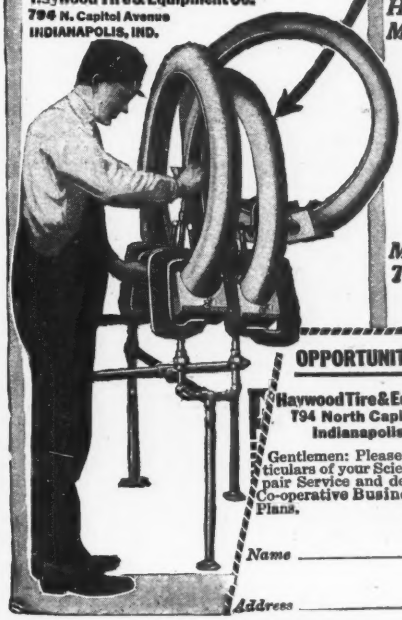

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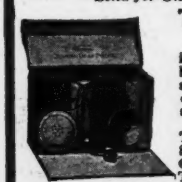

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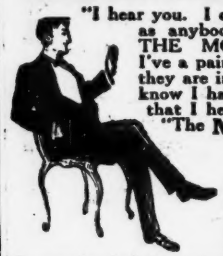

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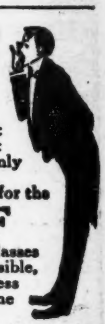

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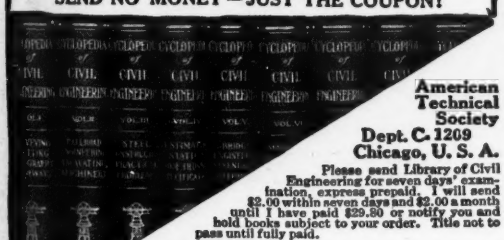

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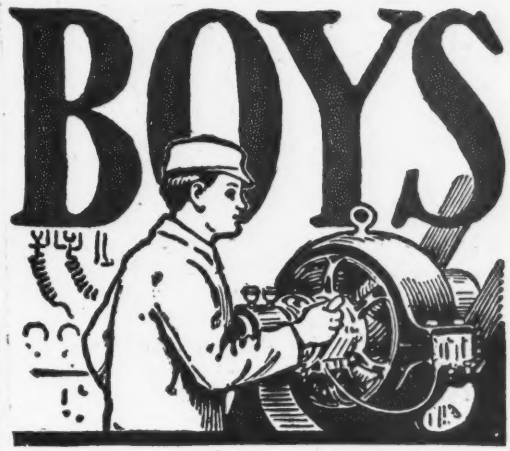

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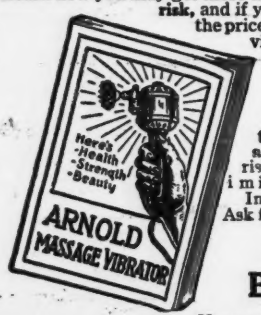

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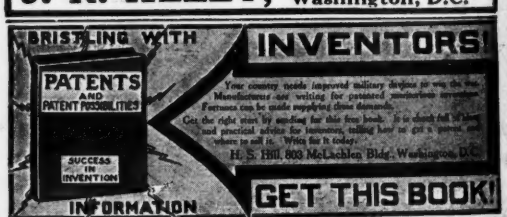

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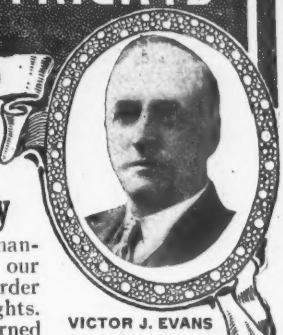

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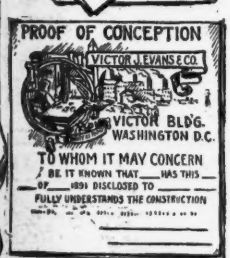
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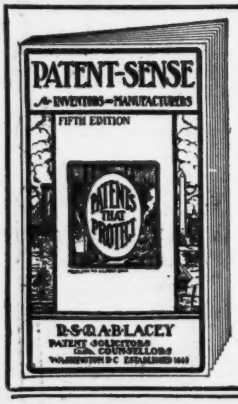

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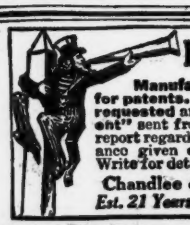

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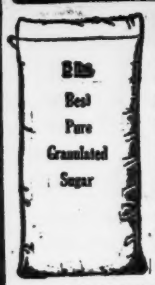

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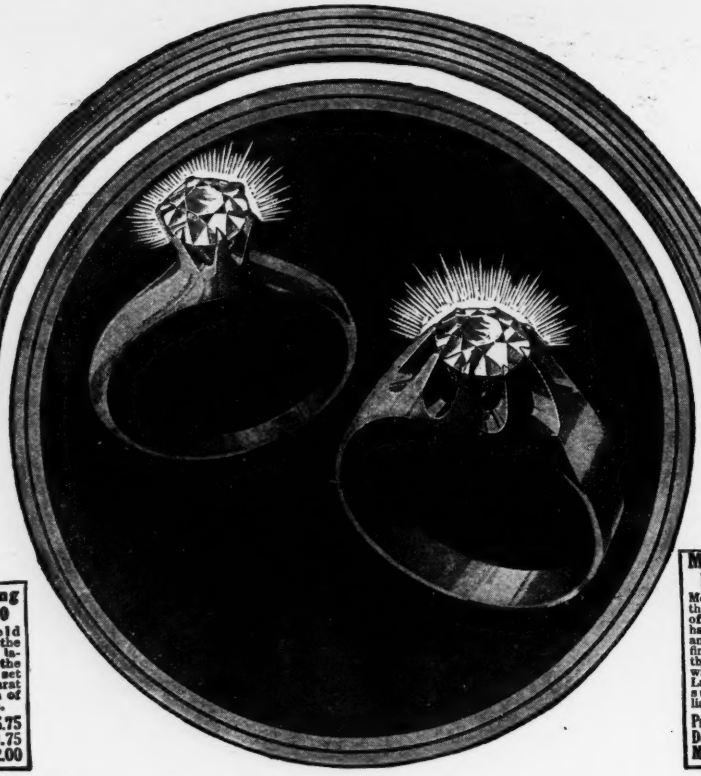

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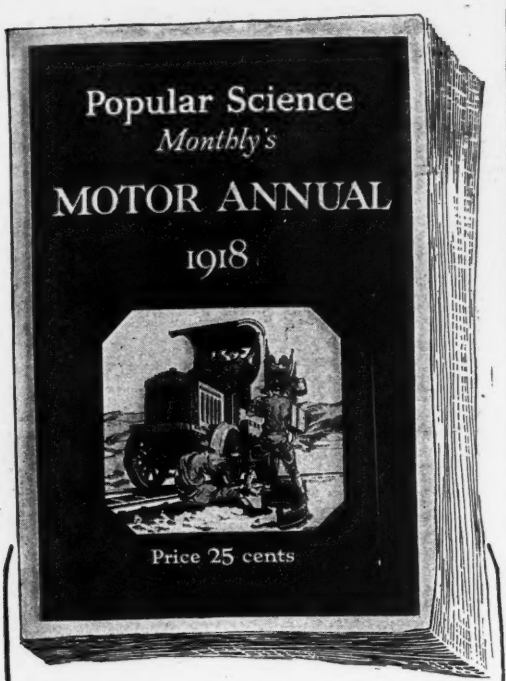

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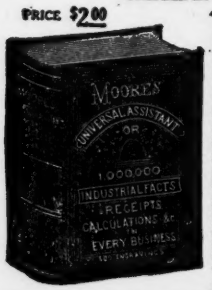

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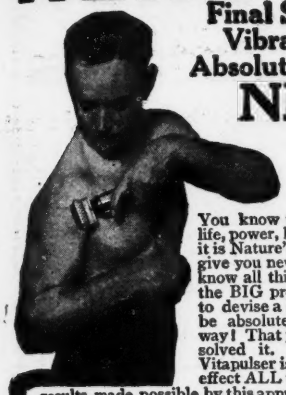

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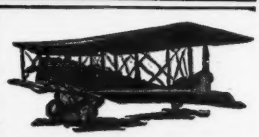

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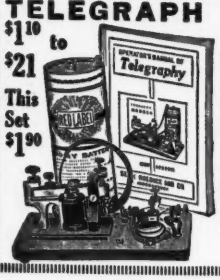

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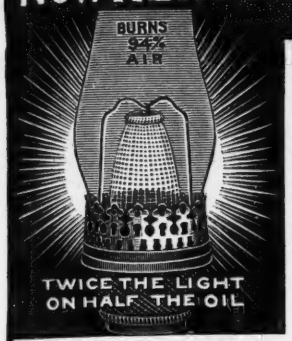

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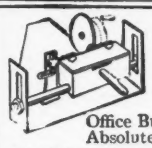

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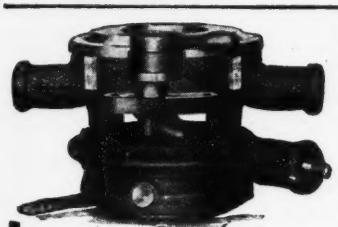

No. 102 Ratchet ¼ in. to 1 ¼ in.

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WHEN threading pipe take advantage of the 5 Big Oster Features. They save time, fuss and labor.

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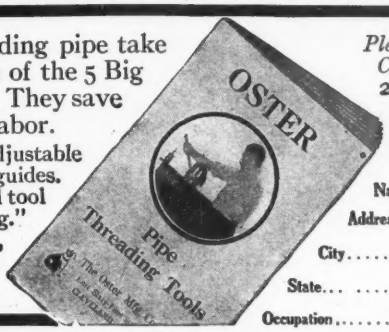

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THREADING straight pipe, bent pipe, nipples and bolts, and requiring only a few square feet of floor space, an Oster pays big dividends in money saved over hand-threading; three days' work a month pays a profit on the investment.

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4 sizes, belt or motor drive

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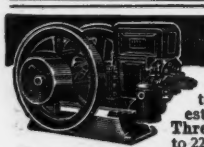

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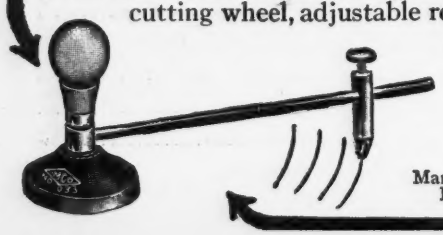

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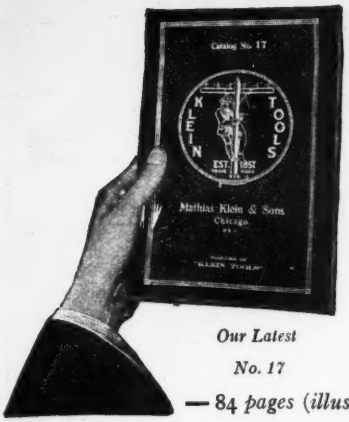

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SPIRAL RATCHET
(right, left and rigid)
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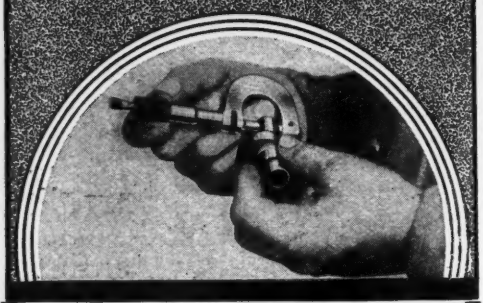

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Eighteen other styles and sizes—quartered and plain oak and leatherette covered. Perfectly designed. Guaranteed.

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Can be adjusted to the variations in the size of fittings.
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They do their work faithfully like all good saws should—easily—quickly—smoothly.

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whether screw pitch, thickness, radius, tap, taper, wire or drill—you will find them useful in determining thickness, radii of fillets, comparisons of screw pitches, and measuring tapering parts.

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Insures better welds, quicker work and lower operating costs. Offers a simple, inexpensive welding outfit for all classes of work. Prest-O-Lite Dissolved Acetylene is furnished in convenient cylinders, making the welding outfit portable for use inside or outside the shop. The Prest-O-Lite System of exchanging empty cylinders for full ones insures universal, perpetual service. Avoids large initial investment and depreciation.

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Toolsmiths

GREENFIELD, MASS.

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Hacksaws	Screw-drivers
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THE only way you can be positively sure that your radiator won't freeze up is to use a non-evaporating anti-freeze preparation. You can never be sure of Alcohol or any other product which evaporates with the water.

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Johnson's Freeze-Proof does not evaporate with the water. One application is sufficient for the whole winter unless the solution is weakened by leakage of the radiator or hose connections, through the over-flow pipe or by boiling water.

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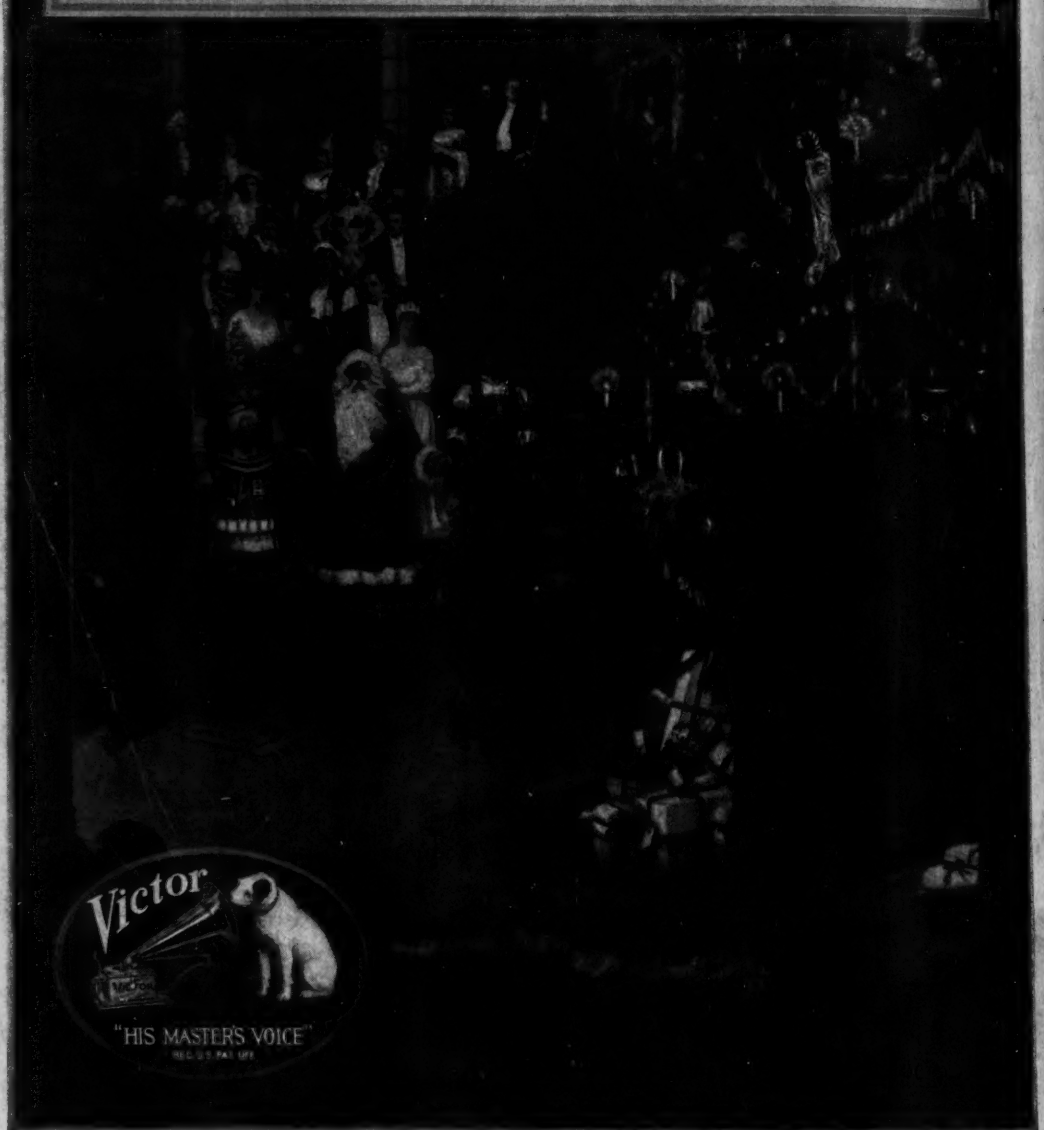
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